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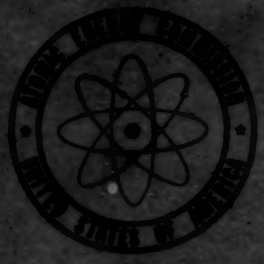
UNITED STATES ATOMIC ENERGY COMMISSION

Nuclear Science Abstracts

Covering the Literature on Atomic Energy
in the Fields of

Biology Medicine Chemistry
Biophysics Physics Engineering
Metallurgy

Vol. 5 No. 13
July 15, 1951



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NUCLEAR SCIENCE ABSTRACTS

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ERRATA

NSA, Vol. 5, No. 9, Reports Reference List. Change first report number AECD-2952 to AECD-2979.

NSA, Vol. 5, No. 10, Reports Reference List. After AECU-1135 insert the following line:

AECU-1137	The Survival of Rats Adrenalectomized after X-irradiation. Abraham Edelman and Seymour Katsh.	2317

NSA, Vol. 5, No. 12, Abstract 3157. The report number should be ONRL-114-50, not ORNL-114-50 as printed.

NSA, Vol. 5, No. 12, Reports Reference List. After AECU-1185 insert the following line:

AECU-1187	The Radiation Induced Reduction of Ceric Ion in Tritium Oxide-Water Solutions. G. E. Challenger and G. K. Rollefson.	3118

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GENERAL

ATOMIC POWER

3285

Columbia Univ.
POWER RECOVERY AT BROOKHAVEN; REPORT NO. 1. Charles E. Lucke. June 16, 1949. Decl. Jan. 25, 1951. 125p. (AECD-3052)

This is the first report on the study made of possible power recovery, without excessive cost, from the operation of the Brookhaven reactor. General conditions imposed include the generation of electric power from the reactor coolant air by steam boilers that cool the air between the reactor and the stack fans, supplying condensing steam turbine generators to reduce purchased electric power for the fans, cooling towers being used to limit consumption of raw water. The hot air which is the source of heat for the boiler will be available at some temperature between 400 and 500°F, and the hourly heat available will be such as corresponds to the reduction of air temperature to as low a value as feasible, with an hourly air flow of the general order of 1,000,000 to 1,250,000 lb/hr. A general problem is set up on the assumption that 100,000,000 Btu/hr are to be transferred from the hot air to the water and steam in the boiler. The specific problem is then to find what boiler pressure or turbine initial steam pressure will produce the highest net kwhr/yr, with the turbine back pressure due to available condenser-circulating-water temperature, without excessive cost of equipment or of operation. The detailed steps are reported in tables and plotted on a base of steam pressure, the conclusions being based on the slopes of the heating surface and the kw curves, and on the shape of the curve of ratio of heating surface to kw.

BIOLOGY AND MEDICINE

3286

Radiation Lab., Univ. of California
MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT; JULY, AUGUST, AND SEPTEMBER 1950. (Excerpt UCRL-960 appeared in NSA 5-1786). Nov. 8, 1950. Decl. Apr. 24, 1951. 75p. (AECD-3141; UCRL-960)

The Metabolic Properties of Plutonium and Allied Materials. Rats which had been subjected to a smoke chamber containing Pu were sacrificed 64 days after exposure, and histologic sections of their lungs were prepared. Representative radioautographs made from these sections are presented and discussed. The fate of terbium has been studied in rats. Pile-produced Tb^{160} was used as a tracer. Metabolism studies in rats of carrier-free Sc^{45}, Ta^{182}, Mn^{52}, Cr^{51}, and At^{211} also are summarized. The effect of whole-body irradiation on the extra- and intracellular distributions of Na^{22} and K has been studied. The effects of chelating agents in vivo on the excretion of Pu^{239} and Ce^{144}, and in vitro experiments on the chelation of Be are reported. Results of a metabolism study of Ca^{45} in young, adult, and rachitic rats are given; this study, by D. M. Thomson and D. Harold Copp, has been excerpted from this report and has appeared in Nuclear Science Abstracts as NSA 5-1786. Radiochemistry. Methods of preparation of carrier-free Cr^{51}, Sc^{46}, $Bi^{204,206}$, and Mn^{52} from V, Ti, Pb, and Cr, respectively, are summarized. Biological Studies of Radiation Effects. Evidence of a Combined Target-Intermediate Action Mechanism of Radiation Effects. A parallelism is demonstrated between the so-called indirect mechanism of radiation effect and the target theory. The apparent contradiction in the two theories may be eliminated by using the "diffusion model" of radiation effects, which assumes the formation of intermediates by the ions of the primary radiation. The formulation of the diffusion model allows for variation in radiation sensitivity with substrates, state of cell division, water content, etc.; it furnishes clues for study of the quantitative effects of externally applied cell poisons. The mechanism of inhibition of cell division by radiation may be quantitatively accounted for in haploid, diploid, and tetraploid yeast cells. 13 figures. 19 references. Health Chemistry and Physics. Activities in monitoring, transportation, decontamination, dispersal, and storage of radioactive materials and surveys of the radiation field of the 60-in. cyclotron and of the fast-neutron field produced by the synchrotron are summarized.

3287

Brookhaven National Lab.
ABSORPTION SPECTRUM OF THE FEULGEN-NUCLEAL COMPLEX IN VITRO AND IN SITU. M. J. Moses. [nd] 2p. (AECU-1163)

The report is reproduced here in its entirety.

The Feulgen reaction is being widely used as a quantitative measure of the desoxypentose nucleic acid (DNA) content of nuclei. However, certain basic information concerning the chemical reaction has been lacking. For instance, no careful spectrophotometric measurement of the absorption spectrum of DNA-regenerated leucobasic fuchsin of the

Feulgen reagent, either in solution or in intact nuclei, has appeared. The need for further data is clear in view of the requirements of any quantitative colorimetric method. The Feulgen reaction was carried out on hydrolyzed solutions of DNA and the optimal hydrolysis time was determined (maximum $E_{550m\mu}$). The DNA-Feulgen complex was shown to obey Beer's law. Beckman spectrophotometer determinations resolved the previously reported broad absorption maximum into two maxima, one at about 550 mμ and another at about 575 mμ. The characteristic absorption spectrum of formalin-regenerated reagent, on the other hand, showed only one sharp peak at 545 mμ. It was clear that the two regenerated complexes were not alike. The maxima of the DNA-regenerated reagent were not sharply separated, but the absorptions at these maxima could be varied independently of each other by varying hydrolysis time, pH, and presence of protein. Absorption spectra of the Feulgen-DNA complex in nuclei were obtained for comparison in the following way: The Feulgen reaction was carried out on sections of Trillium erectum anthers. An image of a single pachytene pollen mother cell nucleus was projected by means of a microscope and diaphragm system to fill the slit of a 2-m grating spectrograph. The image of the resulting transmission spectrum was recorded on a photographic plate and the plate was scanned by a recording densitometer. The procedure was repeated for an adjacent blank area of the slide. From the two curves thus obtained a resultant curve was derived, representing the absorption spectrum of the nucleus. This curve showed two distinct and deeply separated adsorption maxima, one at about 550 mμ and the other at about 585 mμ. These observations demonstrate the common origin of the dye complex in the nucleus and the DNA-Feulgen complex in vitro. The significance of the two maxima and the reason for their marked differentiation in the cytological sections is not understood.

3288

New York Medical Coll.
ON THE GELATION PHASE OF BLOOD COAGULATION. (abstract) Alfred Lewin Copley. [nd] 1p. (AECU-1233)

The report is reproduced here in its entirety.

The existence of the gelation or third phase of blood coagulation was postulated (Copley, Abstracts of Communications, XVIII International Physiological Congress, Copenhagen, August 15–18, 1950, p.165) on the basis of anomalous findings of decreased coagulability (hypocoagulability), as measured by a slight modification of the blood-saline coagulation time test (Copley and Houlihan, Science 100, 505(1944); Copley, Science 101, 436(1945)) and normal prothrombin time. Conversely, normal blood coagulability or increased coagulability (hypercoagulability), and marked prolongation of prothrombin time, as induced by Dicumarol and Tromexan in rabbits, were also found. The latter incongruence of blood coagulability and prothrombin activity does not permit the designation of the chemical hemorrhagic agent Dicumarol as a true anticoagulant. Heparin inhibits, both in vitro and in vivo, the gelation phase and therefore is regarded as a true anticoagulant. On the other hand, total-body x irradiation, a physical hemorrhagic agent, applied in doses of 700 and 800 r in rabbits, only occasionally produced hypercoagulability and hypocoagulability, and did not affect prothrombin activity. Investigations, using model tests concerning the gelation phase, among which the paradoxic effect of Ca in inhibiting gelation in higher blood-saline concentrations, and in accelerating gelation in lower blood-saline concentrations, will be presented [subsequently].

3289

Duke Univ.
STUDIES ON ISOLATED CELL COMPONENTS; I. NUCLEAR ISOLATION BY DIFFERENTIAL CENTRIFUGATION. Karl M. Wilbur and Norman G. Anderson. [nd] 15p. (ORO-15)

A method is presented for isolating nuclei of rat and hamster liver in a high state of purity and in a condition optically similar to nuclei within living cells. The method is based on homogenization and differential centrifugation of fresh liver at 0 to 5°C in a salt-sucrose solution buffered at pH 7.1. 38 references.

3290

EFFECT OF INTRAVENOUS DIGITOXIN ON FLUID DISTRIBUTION IN HOSPITALIZED MALES WITHOUT CARDIOVASCULAR DISEASE. Jerry K. Aikawa, Victor H. Knight, and Malcom P. Tyor. Proc. Soc. Exptl. Biol. Med. 76, 250-2(1951) Feb.

The intravenous administration of 1.2 mg of digitoxin to 5 male subjects with no cardiovascular disorder was found to cause a significant decrease in the serum protein concentration and an increase in the total circulating protein content within 8 hr. The results were interpreted as indicating an increase in the water and protein content of the vascular compartment. (auth)

3291

LIPOPROTEINS AND ATHEROSCLEROSIS. John W. Gofman, Frank T. Lindgren, Hardin B. Jones, Thomas P. Lyon, and Beverly Strisower. J. Gerontol. 6, 105-19(1951) Apr.

Serum lipid transport is describable in terms of a group of lipoprotein macromolecules of differing physical properties and chemical composition. Certain of these lipoproteins (the S_f 10-20 and the S_f 8-10 classes are associated with human atherosclerosis. Patients with myocardial infarction or angina pectoris show consistently higher levels of such molecules than do apparently normal individuals. Hypertensive patients who have coronary artery disease (presumably atherosclerotic in origin) show higher S_f 10-20 20 levels than do individuals with uncomplicated hypertension. Diabetic patients with vascular disease (hypertension and/or coronary artery disease) show higher levels than do diabetic individuals who do not show these complications. The presence of the S_f 10-20 class of molecules in high concentration is noted in such diseases as myxedema, nephrosis, and xanthoma tuberosum where atherosclerosis is excessive.

3292

THE UTILIZATION OF NITROGEN IN VARIOUS COMPOUNDS BY CLOSTRIDIUM PASTEURIANUM. E. D. Rosenblum and P. W. Wilson. J. Bact. 61, 475-80(1951)Apr.

A test, using turbidimetric and Kjeldahl analyses, of the utilization of various postulated intermediates of nitrogen fixation by growing cultures of C. pasteurianum revealed that only ammonia was used at a rate and an extent suggesting a true intermediate. Both hydroxylamine and hydrazine were toxic at relatively low concentrations (5 to 10 μg of N/ml), and, even more important, no evidence of utilization was obtained even when nontoxic levels were supplied. Oximes of pyruvate, oxalacetate, and α-ketoglutarate apparently were used, but the rate was slow. Nitrite and nitrate, not considered to be intermediates, were suitable as sources of N for C. pasteurianum, but only after a period of lag. The N in hyponitrite and nitrous oxide appeared to be unavailable. (auth)

RADIATION EFFECTS

3293

Washington Univ., St. Louis. School of Medicine
METABOLISM OF ANTIGENIC I* PROTEINS; EFFECT OF ANTIGEN AND HOST ALTERATION. S. C. Bukantz, F. J. Dixon, G. J. Dammin, and D. W. Talmage. [nd] 2p. (AECU-1239)

The report is reproduced here in its entirety.

The mechanisms involved in the metabolism of antigens have been investigated (1) in normal rabbits with tracer-labeled I* bovine serum albumin, I* bovine gamma globulin (I*-BGG), and with I*-BGG altered chemically by azo conjugation or iodination to saturation; and (2) with I*-BGG injected into animals after whole-body irradiation, active immunization, passive immunization, and in a specific anamnestic response. I*-BGG disappeared from the circulation in three phases (75% in 24 hr, 92% in 96 hr, and virtually 100% in 9 days) and was never retained in or concentrated by tissues. Complement fixing antibody appeared by the 7th day, was maximal at the 10th, and disappeared by the 20th day. By contrast, R-salt-azo-biphenyl-azo I*-BGG and P-amino benzoic acid-azo-I*-BGG disappeared from circulation precipitously (90% loss in 6 hr and 99% loss in 24 hr) and was retained in the RE macrophages of several organs, notably spleen, liver, and lymph nodes, with an approximate tissue half-life of 3 to 7 days. The I-saturated antigen left the circulation as rapidly as azo antigens, with less tissue retention. Urine excretion of I^{131}-containing protein breakdown products reflected the blood and tissue elimination of antigen. X rays (300 or more r) did not effect the nonimmune rate of elimination of antigen, although the immune response was suppressed. The intravenous injection of antibody to I*-BGG produced a prompt decrease in circulating antigen in proportion to the amount of antibody injected. Finally, in a specific anamnestic response, antigen disappearance during the first 2 days was at the usual nonimmune rates, and a typical immune rate began at the 3rd day.

3294

Washington Univ., St. Louis. School of Medicine
RADIOSENSITIVE AND RADIORESISTANT PHASES IN ANTIBODY PRODUCTION. F. J. Dixon, D. W. Talmage, and S. C. Bukantz. [nd] 2p. (AECU-1241)

The report is reproduced here in its entirety.

The radiosensitivity of the antibody response is well known, but the time relationships of radiation, antigen administration, and antibody suppression or response have not been completely explored. The following observations were made in rabbits using I^{131}-labeled bovine gamma globulin as antigen. Antibody was determined by complement fixation, employing four 50% units. (1) Antibody response to initial antigen exposure is completely suppressed by 300 r or more whole-body radiation given 40 hr before injection of antigen. With 500 r this suppression is evident for 6 weeks. (2) However, no suppression of initial antibody response is noted following 500 r given simultaneously with antigen, and only partial antibody suppression follows 500 r given 2¼ hr before the antigen. (3) The specific anamnestic response, unlike the initial antibody response, is not prevented by 500 r 40 hr before the second injection of antigen. It is apparent that within a matter of hours after 300 to 500 r radiation an animal loses a substance necessary for the production of antibody. However, since simultaneous radiation and antigen administration does not diminish antibody production in spite of the fact that the necessary radiosensitive substance can persist for only a matter of hours, it would appear that the radiosensitive portion of the antibody response lasts only a few hours. The remainder of the antibody response, during which the antibody protein is actually produced, lasts several weeks and can be carried on undiminished in spite of radiation. The complete radioresistance of the specific anamnestic response indicates a lasting orientation of antibody-producing sites to the specific antigen, so that on second antigen administration the radiosensitive initiation phase of antibody production is unnecessary.

3295

Argonne National Lab.
THE EFFECT OF WHOLE-BODY X-IRRADIATION ON THE METABOLISM OF THE RAT. D. E. Smith, E. B. Tyree, H. M. Patt, and E. M. Jackson. Mar. 1951. 13p. (AECU-1253; UAC-367)

Determinations have been made of the influence of whole-body x irradiation upon the rate of weight loss of the starving rat and upon the level of basal O_2 consumption of both the starved and the fed rat. Since irradiation was without effect upon these quantities it was concluded that single, whole-body exposures to irradiation do not bring about increased metabolism. The discrepancies between these and the previous data which supported the hypothesis of a radiation-induced increase in metabolism are discussed. 11 references. (auth)

3296

Argonne National Lab.
MORPHOLOGICAL AND RESPIRATORY CHANGES INDUCED IN MELANOPLUS DIFFERENTIALIS BY β IRRADIATION. (abstract) Theodore N. Tahmisian and Jean Gasvoda. Feb. 1951. 1p. (AECU-1258; UAC-350)

The report is reproduced here in its entirety.

Prediapause eggs of the grasshopper, Melanoplus differentialis, were exposed to β radiation emanating from P^{32} or Sr^{90} solutions to determine the morphological and respiratory changes that occur during and following such irradiation. Total dosages delivered to the embryos ranged from 3.07 to 1215 r. Extensive damage was seen in the cells at all exposure levels. Respiration was increased during irradiation but was inhibited immediately thereafter. By

use of Flemming's triple stain it was shown that β irradiation caused pyknotic chromatin to appear as though it were in the metaphase condition. An osmophilic material, associated with the chromosomes, was observed following exposure. This material is a lipoid that undoubtedly is a degradation product of lipoproteins known to be present in chromosomes.

3297

Office of Research and Medicine, ORE, AEC
MEDICAL RECORDS PILOT STUDY. Jack Moshman. [nd] 44p. (ORO-13)

A pilot study has been completed of the medical records of operating contractors of the AEC in which it was designed to indicate any statistically significant changes in an individual's laboratory and clinical examination which might be due to chronic exposure to low-level irradiation. 1050 individual cases are considered from both the medical and statistical aspects. The study consisted of a detailed investigation of five specific hematological factors, namely, the red blood cell count, hemoglobin, white blood cell count, percentage of lymphocytes, and the percentage of polymorphonuclear neutrophils.

3298

Tennessee Univ.
QUARTERLY PROGRESS AND WORK ACCOMPLISHMENT REPORT FOR QUARTER ENDING MARCH 31, 1950; AGRICULTURAL RESEARCH PROGRAM. Mar. 31, 1950. 13p. (ORO-21)

Operational and administrative information is given, followed by progress and work accomplishments of the following projects: bomb radiation effects upon farm animals; fission product metabolism in animals; calcium metabolism in animals; radiation effects on reproductive functions in farm animals—sperm physiology studies; radioisotopes in poultry nutrition studies; radioisotopes in the investigation of the physiology of milk secretion; behavior and fate of radioactive calcium after its incorporation in the soil; and the relation of soil types to the availability of nutrients. Although primarily operational information is given, tables list a summary of data on blood analysis studies from 35 UT-AEC Hereford cattle in Oak Ridge herd; tissue distribution of labeled phosphorus (P^{32}) administered orally to the castrated male bovine; and a summary of calcium metabolism—effects of dietary phosphorus levels upon calcium absorption, storage, and turnover in rats; and tissue distribution of labeled calcium (Ca^{45}) administered orally to weanling rats.

3299

Radiation Lab., Univ. of California
LETHAL RADIATION EFFECTS OF X-RAYS, DEUTERONS, AND ALPHA PARTICLES ON THE BACTERIUM ESCHERICHIA COLI. R. Lowry Dobson. Feb. 28, 1951. 64p. (UCRL-1140)

Aerobically grown E. coli strain B and its naturally occurring radiation resistant mutant strain B/r were irradiated in air with x rays, deuterons, and α particles. In all cases typical exponential survival curves were obtained. In this respect the bacteria behaved as would be expected according to simple target theory. B/r was in all cases more resistant than B. Contrary to expectations based on target theory both strains were killed more efficiently by low-energy deuterons than by high-energy deuterons. This same reversal was found in the case of α rays, low-energy particles being more effective than high-energy particles. When x irradiation was carried out in a N_2 atmosphere, survival was increased over that in air. Such a protection was also demonstrated for argon in the case of strain B bombarded with particles. A modified target hypothesis—that the "target" may be inactivated not only by an ionization occurring within its volume, but also by energy transferred from the track of the ionizing particle through a finite distance in the cell, and further, that the probability of this latter mechanism resulting in target inactivation at a given distance increases with ion density along the track—is proposed.

3300

AAAS SYMPOSIUM ON RADIOBIOLOGY. Abraham Edelmann. Nucleonics 8, No. 4, 28-36(1951) Apr.

A summary is presented of 22 papers offered at the 117th meeting of the American Association for the Advancement of Science. The subject matter covered in these papers includes the effects of ionizing radiation on plant growth and development, radiation-induced mutations, neutron irradiation of compounds, action of x rays on cells and rodent testicles, effect of I^{131} on thyroid tissue, spleen shielding, C^{14} metabolism, and radiation-sickness therapy.

3301

CHANGES IN CARCINOMA OF THE BREAST FOLLOWING IRRADIATION. George Lumb. Brit. J. Surg. 38, 82-93 (1950) July.

An abstract of this article appeared in Cancer 4, 428(1951) Mar. and is reproduced here in part.

The histological changes found in 60 cases of breast cancers removed by radical mastectomy following x-ray therapy (220 kv) are described and illustrated, and the results of previous studies of postirradiation change summarized. In some cases serial biopsies were obtained during irradiation. The histological changes are discussed under two headings: (1) cellular effects; (2) connective-tissue changes and replacement phenomena including two hitherto unrecorded types of replacement tissue. A tumor dose of 200 r was found to be insufficient to produce any significant changes. In no case receiving a tumor dose of more than 3500 r could unaltered malignant cells be demonstrated.

3302

HEAT REACTIVATION OF ULTRAVIOLET-INACTIVATED BACTERIA. Edward H. Anderson. J. Bact. 61, 389-94 (1951) Apr.

Ultraviolet-inactivated cells of several strains of Escherichia coli and Saccharomyces cerevisiae have been tested for their ability to be reactivated as a result of heat treatment after irradiation. The magnitude of reactivation obtained, with a 10° difference in incubation temperature, for two strains of E. coli approximates that obtained by photoreactivation. The heat-reactivation phenomenon does not occur to any appreciable extent in x-ray-inactivated B/r cells and only slightly in B cells. Heat reactivation may not be as general a phenomenon as photoreactivation. (auth)

3303

HISTOLOGICAL AND CYTOLOGICAL CHANGES PRODUCED BY ALPHA-PARTICLES IN THE SKIN OF MICE. Finn Devik. Acta Radiol. 35, 149-64(1951) Feb.-Mar.

The histological and cytological changes in the skin of a hairless strain of mice following external α irradiation are described. It is found that the epidermis contains cells that are able to survive doses of the order of 100,000 r. The effects of the α rays, which mainly are localized in the epidermis, have been compared to the effects caused by roentgen rays in the skin. This comparison stresses the great importance of the indirect effects brought about by the stroma-vascular bed, when the latter also is irradiated. 18 references. (auth)

3304

THE IMPORTANCE OF THE RESISTANCE PHASE OF THE ORGANISM AT THE TIME OF APPLICATION OF A LETHAL DOSE OF X RADIATION. H. Betz. Compt. rend. soc. biol. 144, 1439-42(1950) Oct. (In French)

In order to determine whether a radiation-resistance phase could be produced, three lots of C57 mice were irradiated with a nonlethal dose of 500 r of x rays followed at 7, 10, and 15 days, respectively, with a 700-r dose. In contrast to a 700-r-irradiated control lot, all of which succumbed by 10 days, the lots receiving the 7-, 10-, and 15-day fractionated exposures showed decreased rates of mortality and 20, 26.5, and 36% survival, respectively. The protective action of the nonlethal exposure is discussed inconclusively.

3305

PATHOLOGICAL EFFECTS OF ATOMIC RADIATIONS. G. Capretti. Giorn. clin. med. (Parma) 32, 319-55(1951) Mar. (In Italian)

A general survey of pathologic symptoms and lesions produced by ionizing radiations and atomic-bomb explosions is given. 46 references.

3306

QUANTITATIVE EVALUATION OF GROWTH RATES IN TUMORS BEFORE AND AFTER RADIATION. Anna Goldfieder. Cancer Research 11, 169-73(1951) Mar.

Attempts were made to evaluate the rates of growth of tumors before and after radiation on a quantitative biological basis. Chalkley's method, which permits a quantitative evaluation of spatial distribution of morphologic tissue components in an extended volume of tissue, was used for this study. Two mammary tumors of the Bar Harbor dba and C3H strains of mice, both diagnosed as adenocarcinomas and referred to as the dbrB and C3H tumors, respectively, were employed as test objects. Analysis of five dbrB tumors yielded an average ratio of mitotic to resting cells of 1:49.6 (range: 1:43.8 to 1:53.8), while analysis of five mammary tumors of the C3H strain yielded an average ratio of mitotic to resting cells of 1:72.5 (range: 1:63.6 to 1:87.5). It is indicated that the relatively greater increase in size of the dbrB mammary tumor, as compared to the C3H tumor, is due not only to the greater mitotic activity of this tumor but also to its inherent secretory tendency, which produces engorgement of the glandular lumina. Consequently, it is thought advisable to take such a biological characteristic into consideration in evaluating the increase in tumor size as measured externally. Volume ratios of mitotic to intact resting cells of five dbrB tumors, exposed to various doses of x radiation and removed following various periods of time, are presented. Microscopic fields of stained sections of intact portions of the tumor, chosen at random, were used for analysis. A decrease in mitotic activity was noted which depended on the dose of irradiation applied and the lapse of time between exposure and removal of the tumors. For example, 1 mitotic figure to 41.0 resting cells was found in the intact portions of a dbrB tumor 24 hr following a dose of 5000 r; a ratio of 1:87.5 was found in another dbrB tumor which received the same dose of radiation but which was removed 13 days following exposure. The ratio of 1:41.0 is very close to the range of mitotic indices found in untreated dbrB tumors, while the ratio of 1:87.5 indicates a decrease in mitotic activity as compared to the normal. A delayed effect is indicated. The effectiveness of a large dose of radiation is illustrated by the ratio of 1 mitotic figure to 350 resting cells found in a dbrB tumor which was removed and fixed 22 hr following irradiation with 16,000 r. The results obtained indicate the possibility of applying Chalkley's method to the quantitative evaluation of growth rates of tumors, taking the mitotic index as a criterion. This method also proved helpful in evaluating the effectiveness of a given dose of radiation on a quantitative basis. (auth)

3307

ROLE OF THE TIME ELEMENT IN FAST-ELECTRON IRRADIATIONS OF HUMAN SKIN. Richard Kurt Kepp, Kurt Müller, and Herbert Reich. Strahlentherapie 84, No. 2, 225-44(1951). (In German)

Test irradiations of human skin with 3-Mev electrons from a betatron showed that, contrary to what is observed with x rays, in the action of fast electrons the time factor plays a notable part even in the dose-efficiency range 300 to 1800 r/min. This difference is perhaps due to a much less dense ionization in the case of electrons, permitting a partial recovery of the tissue elements if sufficient time intervals between individual hits are given; this recovery effect cannot occur amid the dense ionizations produced by x rays. However, the possible role of the highly fractionated radiation from the betatron also should be taken into account. These results show that, in view of the danger to the skin, fast electrons must be used only in low dose efficiencies.

3308

STUDIES ON THE ALTERATIONS OF DEVELOPMENT OF THE TEETH AND ADJACENT STRUCTURES FOLLOWING LOCAL ADMINISTRATION OF CHROMIC PHOSPHATE CONTAINING P^{32}. M. S. Burstone. J. Am. Dental Assoc. 42, 418-23(1951) Apr.

Injection of suspensions of insoluble chromic phosphate containing P^{32} adjacent to the developing jaws of the mouse produced changes in histodifferentiation and morphodifferentiation of the dentition. These changes included the differentiation of squamous-type cells in the ameloblastic layer instead of the normal columnar type, formation of osteodentin associated with abnormal odontoblasts and formation of osteodentin in the pulp chamber. There was a failure of root development even though there was continued apposition of the coronal

dentin. Marrow aplasia and subsequent fibrosis of the alveolar bone together with formation of immature fibrous bone were characteristic changes. The alterations in development were qualitatively similar to those produced by systemic injection of soluble P^{32} solutions. Areas of oral epithelium including that of the tongue adjacent to the injected region exhibited epithelial cells with greatly enlarged hyperchromatic nuclei. Some abnormal mitotic figures may be present 8 to 15 days following injection. The serous salivary glands were more radiosensitive than the mucous-type glands although areas of mucous glands may show a cystic change together with a squamous metaplasia. (auth)

RADIATION HAZARDS AND PROTECTION

3309

Brookhaven National Lab.
EDDY DIFFUSION FROM ELEVATED SOURCES; THE BROOKHAVEN EXPERIENCE. Philip H. Lowry. [nd] 5p. (AECU-1246)

The eddy diffusion of oil fog from a 355-ft stack has been investigated in order to develop techniques for estimating and forecasting the ground-level ionization produced in air from the radioactive argon gas emitted by the Brookhaven nuclear reactor. It has been found that three basic diffusion regimes exist, each of which is characterized by a distinctive trace on the wind direction record at the 100-meter level. For convenience these regimes have been termed lapse, neutral, and inversion. Lapse conditions are defined as an adiabatic or superadiabatic vertical temperature gradient through the level of the stack. Neutral conditions are defined as a vertical temperature gradient between 0 and $-0.7°C/100$ m, whereas inversion is assumed known from meteorological terminology. The nature of these regimes is discussed briefly.

3310

Atomic Energy Project, Univ. of Rochester
HEALTH HAZARDS IN RADIATION WORK. M. Ingram. Oct. 25, 1950. 15p. (UR-139)

The general subject of health hazards in work with ionizing radiations is discussed. Types of injurious ionizing radiations and examples of occupations in which they may be encountered are reviewed. Minimizing the dangers associated with radiation work involves the recognition of the hazard, the development of conservative criteria for safe working conditions, and the enforcement of safety measures. The importance of educating personnel in such a manner that they appreciate the need for strict observance of routine safety measures is stressed. (auth)

3311

ESTIMATING RADIOELEMENTS IN EXPOSED INDIVIDUALS — III. BIOASSAY OPERATIONS AND PROCEDURES. Jack Schubert. Nucleonics 8, No. 4, 59-67(1951) Apr. (See also NSA 5-1473 and 5-3002)

Based on established practices at Argonne National Laboratory, this paper outlines some practical recommendations for administrative and analytical procedures designed to safeguard laboratory personnel from overexposure to radioelements.

3312

PRECAUTIONS TAKEN IN HANDLING RADIO-ACTIVE IODINE. G. H. Guest and P. M. Bird. Pulp & Paper Mag. Can. 52, No. 3, 147-8(1951).

Safety measures and training lectures concerning the use of I^{131} at a paper plant are reported.

3313

PROBLEMS IN RADIOISOTOPE THERAPY NURSING. Pauline Gazay. Ind. Med. Surg. 20, 234-5(1951) May.

Precautions in the therapeutic use of radioisotopes for both nurse and patient are given with references to intravenous injection and oral dosage.

3314

THE PROTECTIVE POWER OF ROENTGEN GLOVES. Ragnar Steinert. Acta Radiol. 35, 45-8(1951) Jan.

The protective power of roentgen gloves has been measured by placing condenser chambers inside gloves exposed to various amounts of x radiation. Gloves were used which had a lead equivalent of 0.2 to 0.5. An investigation was also made of the amount of radiation received by the unprotected hands. With the screening techniques used by the author, the diurnal maximal roentgen dose on the hands was exceeded in a relatively short time.

3315

RADIOACTIVE DUST SEPARATION EQUIPMENT — I. Allan L. Bralove. Nucleonics 8, No. 4, 37-50(1951) Apr.

The practical and theoretical factors affecting separation equipment design and use for the removal of radioactive dust are presented. A survey is made of units now in use for this purpose.

3316

SAFETY IN THE USE OF RADIOACTIVE ISOTOPES. Edith H. Quimby. Am. J. Nursing 51, 240-3(1951) Apr.

Fundamentals of nuclear physics and precautions in the handling of radioactive isotopes are explained. An illustrative case of the administration of radioactive materials to a patient is described.

RADIATION SICKNESS

3317

FURTHER STUDIES ON RECOVERY FROM RADIATION INJURY. L. O. Jacobson, E. L. Simmons, E. K. Marks, E. O. Gaston, M. J. Robson, and J. H. Eldredge. J. Lab. Clin. Med. 37, 683-97(1951) May.

The 28-day LD_{50} for spleen-shielded mice is ~1100 r of whole-blood x radiation compared to ~550 r for mice without spleen shielding. Unlike glutathione, cysteine, O_2 deprivation, or cyanide intoxication, the "factor" in spleen shielding which effects a significant increase in survival of mice from whole-body x radiation is unnecessary during the actual irradiation process and is definitely effective after irradiation. In these experiments the general as-

sumption is made either that (1) the shielded tissues produce a substance of a noncellular nature which exerts a beneficial effect on the recovery of the irradiated animal or (2) that cells migrate from the shielded tissue which enhance recovery of the irradiated tissues. The evidence appears to be in favor of the first assumption. The potential significance of these observations to the therapy of radiation injury and other clinical syndromes is discussed briefly.

3318

RADIATION SICKNESS AND ITS TREATMENT WITH DRAMAMINE. Edward DeFeo, Paul H. Reitman, and M. Herbert Nathan. Radiology 56, 420-2(1951) Mar.

One hundred patients were given dramamine as soon as symptoms of radiation sickness appeared following radiation treatments. In only 46 of these patients was any improvement noted following treatment with dramamine. One-half of this number had no recurrence of symptoms after administration of the drug for 1 day (400 mg). In the remainder, it had to be given daily throughout the period of irradiation. In the latter group, symptoms recurred on an average of 2.1 days after the drug was discontinued. Because of this recurrence of symptoms, it was possible to observe the effect of placebos given at intervals during irradiation in 24 of the 46 patients claiming improvement with dramamine. The placebo was identical in appearance and taste to the drug. Seventeen of the 24 patients (70%) did as well with the placebo as with the drug itself, reducing the actual number of patients whose improvement could be credited to dramamine to 29. These results emphasize the important role of psychogenic factors in radiation sickness, and the care which must be exercised in drawing conclusions as to the effectiveness of any drug in a syndrome in which criteria of improvement are mainly subjective. In 11 of the cases dramamine produced undesirable side effects, consisting of intense drowsiness in 6, giddiness in 3, and a metallic taste in 2. The drowsiness was of such a degree that the medication had to be discontinued, since this side effect was more debilitating than the radiation sickness. As a result of this experience the authors believe that the effectiveness of dramamine in radiation sickness is proportional to its antihistaminic effect. It is generally known to be one of the less effective of the antihistamines. The problem of radiation sickness will not be solved until there is more general agreement as to its cause. Only then can treatment be directed to the underlying factors and not to the symptoms alone.

3319

THE TREATMENT OF DISTURBANCES FOLLOWING RADIUM THERAPY WITH DESOXYCORTICOSTERONE. R. Grattarola and M. Bassi. Minerva gin. 2, 188(1950). (In Italian)

The following abstract by J. K. Narat appeared in Surg. Gynecol. Obstet. 92, 99-100(1951) Jan. and is reproduced here in its entirety.

The observation that patients with asthenia, apathy, and hypotonia following intensive radium treatment benefit from the administration of suprarenal cortical extract induced the authors to study the biochemical changes produced by desoxycorticosterone. The substance was given patients undergoing radium therapy on account of cancer of the uterus or endometriopathy. It was noticed that radium treatment was followed by hypoproteinemia, hypotension, increase of the nonprotein nitrogen in the blood, and hyperglycemia. After the administration of desoxycorticosterone, hyperglycemia and hypoproteinemia were also observed; the increase of nonprotein nitrogen was more marked than in the control cases and the blood pressure showed no changes. The sodium and chloride contents of the blood likewise remained unchanged. Hypoproteinemia was better tolerated when desoxycorticosterone was administered. While of the 15 patients in the control group, 7 suffered from asthenia, nausea, vomiting, and diarrhea, only 2 patients in the group of 20 treated with desoxycorticosterone were complaining of asthenia.

RADIOGRAPHY

3320

THE PROPERTIES OF FINE-GRAINED PHOTOGRAPHIC EMULSIONS USED FOR MICRORADIOGRAPHY. A. Engström and B. Lindström. Acta Radiol. 35, 33-43(1951) Jan.

The properties of fine-grained film emulsions, Lippmann emulsion and Eastman Kodak Spectroscopic Plates 548-0 and 649, have been examined with reference to their use in microradiography. Density curves, resolving power, homogeneity of emulsion, development artifacts, and emulsion shrinkage have been examined for 4.50-kv roentgen rays.

3321

THE RELATION BETWEEN TENSION AND EXPOSURE TIMES IN RADIOGRAPHY. A. Bierman and W. Hondius Boldingh. Acta Radiol. 35, 22-5(1951) Jan.

Experiments, carried out under widely varying conditions, have proved that the density of a radiograph remains practically constant when varying kv and ma in such a way that the value of the product $(kv)^5 \times ma$ is kept constant. Application of this rule does not give intolerable deviations in the whole field of diagnostics. (auth)

RADIOTHERAPY

3322

PHOSPHORUS-BAKELITE BETA-RAY SOURCES. O. M. Bizzell, W. T. Burnett, Jr., P. C. Tompkins, and L. Wish. Nucleonics 8, No. 4, 17-27(1951) Apr.

A detailed study was made of the physical, chemical, and radiochemical properties and health-safety requirements for the phosphorus-bakelite β-ray sources available from the AEC in the form of disk-shaped plaques. Specifications for plaque material are given, and details of improved instruments and methods for measuring the specific activities and radiation intensities of the plaques are discussed.

3323

RADIOACTIVE IODINE IN THE TREATMENT OF ANGINA PECTORIS. Charles C. Wolferth, Richard H. Chamberlain, and John J. Mead. Penn. Med. J. 54, 352-8(1951) Apr.

I^{131} in appropriate dosage is capable of relieving otherwise intractable severe anginal pain. In the 28 patients to whom this treatment has been applied during a period of 2 yr to 6 months prior to their last follow-up studies, 10 have died, 12 have obtained what has been arbitrarily designated as a "good" result, 4 a "fair" result, and 2 an "unsatisfactory" result. In the patients who died, the outcome was not regarded as due to the results of radioactive iodine, but the possibility that deposition of cholesterol in coronary arteries may be accelerated after thyroid function is depressed cannot be excluded. (auth)

3324

SOME VARIED APPLICATIONS OF RADIOACTIVE ISOTOPES TO THE LOCALISATION AND TREATMENT OF TUMOURS. D. W. Smithers. Acta Radiol. 35, 49-61(1951) Jan.

The treatment of 96 patients with cancer by means of radioactive isotopes at the Royal Cancer Hospital, London, from December 1948 to June 1950 is reported. Examples are given of the use of I^{131}, P^{32}, and Au^{198} for selective localization, of Au^{198} as a colloidal suspension for local infiltration and intracavitary injection, of Na^{24} and Br^{82} for intracavitary treatment in a latex bag, of Ta^{182} for interstitial implantation, and of P^{32} in polythene as a surface applicator.

3325

USE OF A 23-MEV MEDICAL BETATRON. J. S. Laughlin. Nucleonics 8, No. 4, 5-16(1951) Apr.

A detailed account is presented of the properties of the betatron which make it suitable for use on human patients for cancer therapy. Consideration is given to shielding of the operator and patient. Extensive measurements are reported of stray radiation around the betatron, in the treatment room, and in the adjoining control room.

TRACER APPLICATIONS

3326

Argonne National Lab.
EFFECT OF SODIUM AND ZIRCONIUM CITRATES ON BLOOD LEVEL, DISTRIBUTION, AND EXCRETION OF INJECTED RADIOLEAD. Jack Schubert and Marcia R. White. Feb. 1951. 22p. (AECU-1227; UAC-356)

The effects of Zr and Na citrates on the blood disappearance, tissue distribution, and excretion of soluble Pb salts injected intravenously into rats at two concentrations — carrier-free and with added carrier — have been studied. At the tracer level, Pb^{210} disappeared from the blood (essentially the cellular fraction) with a half time of 30 hr. When injected with carrier Pb, the half time of disappearance of Pb^{210} from plasma was 42 min. Na or Zr citrate injected after carrier-free Pb^{210} did not affect the rate of disappearance of Pb^{210} from the blood, the tissue distribution, or the fraction excreted. In rats injected with carrier amounts of Pb labeled with Pb^{210}, Zr and Na citrate both caused some redistribution of Pb^{210}, but neither affected the immediate rate of disappearance of Pb^{210} from the blood. Zr citrate caused at least a threefold increase in the Pb^{210} excreted during the first 24 hr. The action of many drugs used to treat Pb poisoning is explained by the supposition that they slow down the rate of transfer of Pb from the tissues into the circulation; the ensuing natural rapid drop in the plasma Pb level relieves the symptoms of Pb poisoning. (auth)

3327

Washington Univ., St. Louis. School of Medicine
ANTIGEN ELIMINATION FROM THE BLOOD AS A QUANTITATIVE MEASURE OF THE IMMUNE RESPONSE. D. W. Talmage, F. J. Dixon, S. C. Bukantz, and G. J. Dammin. [nd] 18p. (AECU-1238)

The rate of elimination of I^{131}-labeled bovine gamma globulin from the blood of a rabbit provides an accurate quantitative measure of the immune response to this antigen. The antigen elimination rate indicates an immune response several days before antibody can be detected. Antigen elimination rate is more sensitive than antibody determinations in detecting minimal immune responses. Accelerated antigen elimination (indicator of immune response) is probably caused by combination of antigen and antibody with rapid removal of the combination from the blood. (auth)

3328

Brookhaven National Lab.
UPTAKE BY DUCK ERYTHROCYTES OF IRON ADDED TO BLOOD. L. M. Sharpe, P. S. Krishnan, and J. Raymond Klein. [nd] 15p. (AECU-1244)

Iron added to duck blood as the ammonium citrate was found to be taken up to an appreciable extent by the erythrocytes during incubation at 37°C. Uptake at 3°C was markedly less than at the higher temperature. Cyanide, but not carbon monoxide, depressed the uptake. Some of the iron entering the cells was recoverable as hemin. Synthesis of heme by the cells accounted for the recovery of the added iron as hemin. The uptake also occurs in pigeon, rat, dog, and human blood. (auth)

3329

Wisconsin Univ. Coll. of Agriculture
ISOLATION OF THE KEY INTERMEDIATE IN BIOLOGICAL NITROGEN FIXATION. I. Zelitch, E. D. Rosenblum, R. H. Burris, and P. W. Wilson. [nd] 7p. (AECU-1254)

Clostridium pasteurianum cells actively fixing molecular nitrogen were supplied N_2^{15} for a short time resulting in free ammonia with an extremely high N^{15} concentration being isolated from the supernatant medium. Somewhat lower concentrations, but still considerably in excess of the average of either the intact cells or the supernatant medium, were found in the amide fraction. These data provide direct support for the view that ammonia is a key intermediate in biological nitrogen fixation. (auth)

3330

Argonne National Lab.
ELIMINATION OF INTRAVENOUS CARBON^{14} BICARBONATE BY MAN. (abstract) Donald L. Buchanan. Feb. 1951. 1p. (AECU-1262; UAC-359)

The report is reproduced here in its entirety.

A body of data has been obtained concerning the excretion rates and tissue retention of inorganic C^{14} administered to rats and mice. The present study compares the human ex-

cretion of injected $NaHC^{14}O_3$ to rates observed in smaller animals in order to provide a basis for the computation of permissible human doses of this isotopic compound. In this work 10 μc of material was injected intravenously into healthy human volunteers and all expired CO_2 was collected in fractions during the following 3 hr. With the subject at rest, approximately 75% of the radioactivity is exhaled as CO_2 during the 1st hr; 90% is gone in 2 hr; and 95% has been blown off at the end of the 3rd hr. Within the error of the methods used the rate of isotope excretion by different-sized animals is proportional to the metabolic rate per unit mass of animal. When published data of others are included, this relation seems valid for animals as large as the cow (Kleiber) and as small as the mouse. On this basis the extrapolation to man of information obtained in long-term experiments with rats and mice indicates that an intravenous injection of 20 to 40 mc of $NaHC^{14}O_3$ or the inhalation of a comparable amount of $C^{14}O_2$ would be required to give a 70-kg man a total radiation dose of 1 roentgen equivalent over his entire life span.

3331

Oregon Univ. Medical School
REPORT OF RESEARCH ACTIVITIES OF THE C^{14} ISOTOPE LABORATORY OF THE DEPARTMENT OF BIOCHEMISTRY OF THE UNIVERSITY OF OREGON MEDICAL SCHOOL, PORTLAND. [nd] 31p. (AECU-1271)

Conversion factors for certain C^{14} standard sources are listed for end-window G-M tubes and gas-flow counters. Experiments are reported on uptake of C^{14}-carboxyl-labeled acetate by mice and rats to determine the amount necessary for adequate biosynthetic labeling and the validity of the biochemical fractionation techniques used. Labeled cholesterol has been used to evaluate a detailed fractionation procedure. The effect of fasting upon the ability of the rat to synthesize fatty acids and cholesterol is reported. Rapidity of cholesterol synthesis is shown. Preliminary results of studies of the rate of C^{14} incorporation into various tissue lipid fractions and metabolism of ethanol are presented.

3332

Duke Univ. School of Medicine
THE USE OF RADIOPHOSPHORUS IN STUDIES OF THE GLOMERULAR PERMEABILITY OF PLASMA INORGANIC PHOSPHATE. Philip Handler and David V. Cohn. [nd] 29p. (ORO-14)

When single tracer doses of P^{32} with or without carrier were intravenously injected into dogs, the specific activity of the urinary inorganic phosphate was found to be as much as 32% above that of the specific activity of the corresponding plasma inorganic phosphate. This difference usually disappeared within 25 min. When the specific activity of the plasma inorganic phosphate was caused to rise, fall, or remain constant, the differences in specific activity between urine and plasma inorganic phosphate were markedly altered or entirely abolished. When a small amount of radioactive plasma from an apparently "equilibrated" dog was given to a second dog, differences in specific activity of urine and plasma inorganic phosphate were of the same order of magnitude as in animals receiving untreated P^{32}. It is concluded that the greatest part of these differences may be explained on the basis of a lag which exists between the time inorganic phosphate is filtered by the glomerulus and the time at which it reaches the bladder for collection. The evidence suggests that the majority of the inorganic phosphate of plasma exists in a simple, filterable state. 14 references. (auth)

3333

Radiation Lab., Univ. of California
DISTRIBUTION OF RADIOACTIVITY IN THE EGG AFTER FEEDING SODIUM ACETATE-1-C^{14}. David Kritchevsky, C. R. Grau, B. M. Tolbert, and Barbara J. Krueckel. Feb. 6, 1951. 12p. (UCRL-1108)

Radioactivity was found in the yolk, albumen, and shell of eggs following the feeding of sodium acetate-1-C^{14} to a hen. (auth)

3334

Atomic Energy Project, Univ. of Rochester
THE SYNERGISTIC EFFECTS OF CORTISONE AND INSULIN ON LIPOGENESIS IN THE PERFUSED RAT LIVER AS STUDIED WITH α-C^{14}-ACETATE. Kurt I. Altman, Leon L. Miller, and Chauncey G. Bly. Nov. 29, 1950. 9p. (UR-144)

Cortisone and insulin, when acting concomitantly, exert a marked effect on fatty acid synthesis without affecting cholesterol synthesis. This effect is greatest in triglyceride fatty acid synthesis, but also manifests itself in phospholipid fatty acid synthesis. Insulin alone produces a moderate increase in isotope incorporation into fatty acids. The effect of insulin alone differs from the effect of combined cortisone and insulin in a quantitative manner as regards fatty acid synthesis and glucose utilization.

3335

EFFECTS OF RESPIRATION INHIBITORS ON ACCUMULATION OF RADIOACTIVE PHOSPHORUS BY ROOTS OF LOBLOLLY PINE. Paul J. Kramer. Plant Physiol. 26, 30-6(1951) Jan.

A study was made of the effects of various respiration inhibitors on the accumulation of P^{32} by mycorrhizal and nonmycorrhizal roots of loblolly pine. The inhibitors tested were 0.001M NaN_3, 0.005M NaF, and 0.025M malonic acid. The roots were exposed to the inhibitors for an initial period of 1 hr, then exposed to inhibitor plus P^{32} having an activity of about 300 μc/liter for 3 hr. Azide reduced accumulation to a greater extent in nonmycorrhizal than in mycorrhizal roots at all pH values. The inhibition was almost complete at pH 4.7, but much less at pH 5.7. Fluoride also almost completely inhibited accumulation at the lower pH, but increased it above the control rate at the higher pH. Malonic acid did not significantly reduce accumulation at the lower pH, but increased it above control at the higher pH. The pH of the system has a marked effect on the action of all three inhibitors. In general, pine roots seem to react to respiration inhibitors in about the same manner as barley and tomato roots, although barley roots appear to be more sensitive to malonic acid than are pine roots. It was concluded that, although both types of pine roots contain an azide- and a fluoride-sensitive respiratory enzyme system, that of nonmycorrhizal roots is much more sensitive than

that of mycorrhizal roots. Two types of roots are reported to be somewhat different physiologically.

3336

RATE OF EXCRETION OF N^{15} AFTER FEEDING N^{15}-LABELED l-ASPARTIC ACID IN MAN. Hsien Wu and Selma E. Snyderman. J. Gen. Physiol. 34, 339-45(1951) Jan. 20.

One human adult and six infants were fed l-aspartic acid labeled with N^{15}. The total N and N^{15} concentrations were determined in the urine from time to time over a period of 30 hr. Data are presented on the rate of turnover of N, rate of protein synthesis, and size of N pool in infants and an adult.

3337

NITROGEN FIXATION AND HYDROGENASE IN VARIOUS BACTERIAL SPECIES. E. S. Lindstrom, S. M. Lewis, and M. J. Pinsky. J. Bact. 61, 481-7(1951) Apr.

Five members of the family Athiorhodaceae (Rhodospirillum sp., Rhodopseudomonas capsultatus, Rhodopseudomonas gelatinosa, Rhodopseudomonas spheroides, and Rhodopseudomonas palustris) have been shown, in part by N^{15}-tracer tests, to fix molecular N. Nineteen different strains of rhodopseudomonads were shown to fix N. Rhodomicrobium vannielli, an unassigned photosynthetic bacterium, also has been demonstrated to fix N. Although these species apparently possess the enzyme hydrogenase, the mere presence of this enzyme does not imply that an organism has the ability to fix molecular N. This conclusion follows from experiments with Escherichia coli and Hydrogenomonas, neither of which fixed N under the conditions employed. (auth)

3338

TREATMENT OF MOSQUITO LARVAE AND ADULTS WITH RADIOACTIVE PHOSPHORUS. W. W. Yates, C. M. Gjullin, Arthur W. Lindquist, and Joseph S. Butts. J. Econ. Entomol. 44, 34-7(1951) Feb.

Results of studies made to determine how best to introduce radioactive phosphoric acid (containing P^{32}) into both larvae and adult mosquitoes in amounts that would be detectable with radioactivity measuring devices are reported.

3339

UPTAKE OF RADIOACTIVE IODINE AFTER INTRAVENOUS ADMINISTRATION OF TRACER DOSES. Joseph P. Kriss. J. Clin. Endocrinol. 11, 289-97(1951) Mar.

The thyroid uptake of I^{131} after intravenous administration has been studied in euthyroid subjects and in patients with various thyroid states. The uptake value 1 hr after administration of the tracer has been found to differentiate satisfactorily between the euthyroid and hyperthyroid state, and it exhibits excellent correlation with the degree of clinical toxicity. The method also offers advantages over the 24-hr oral method in rapidity and in diagnostic accuracy by reducing the overlap values between normal and hyperthyroid subjects. (auth)

3340

URINARY EXCRETION OF GALLIUM BY MAN AND ANIMALS. J. I. Munn, N. H. Walters, and H. C. Dudley. J. Lab. Clin. Med. 37, 676-82(1951) May.

A method is described for the separation of Ga from urine by ether extraction of 6N HCl solution. Colorimetric or fluorimetric estimation of 8-hydroxyquinoline–Ga complex in chloroform is the basis for quantitative determination. In the rabbit and dog, intravenous injection promotes greater retention of parenterally administered Ga citrate, with lessened urinary excretion. The 24-hr urinary excretion of Ga by 22 patients varied widely. Studies of the rate of urinary excretion of Ga^{72} in man and dog indicate that in both the initial excretion rate is high and reaches a low level in less than 18 hr. Blood-Ga levels fall rapidly after intravenous injection and approach low constant values within 6 hr. (auth)

CHEMISTRY

3341

Utah Univ.
SURFACE HYDROLYSIS IN Na-LAURYL SULFATE SOLUTIONS AND ITS EFFECT ON SURFACE TENSION AND ON ADSORPTION AT THE SOLID AQUEOUS SOLUTION INTERFACE. (Technical Report No. II) Melvin A. Cook and Eugene L. Talbot. Jan. 1, 1951. 14p. (AECU-1270)

Hydrolytic adsorption at the free surface of aqueous sodium lauryl sulfate solutions is shown by pH measurements correlated with (foam) extraction of the soap and by means of surface tension γ versus pH curves at constant concentration and ionic strength. Values of the (apparent) surface hydrolysis constant of 10^{-7} to 10^{-8} were obtained from the γ versus pH curves. However, the hydrolytic adsorption may perhaps be due merely to a fatty acid impurity in Na-lauryl sulfate. A series of surface tension–concentration curves were obtained at various ionic strengths, and a thermodynamic analysis and interpretation is given. (auth)

3342

Los Alamos Scientific Lab.
PHASE DIAGRAM OF DILUTE SOLUTIONS OF He^3 IN He^4 BELOW THE LAMBDA POINT. H. S. Sommers, Jr. [Mar. 1951]. 18p. (AECU-1288; LADC-958)

Studies have been made of the He^3 concentration of both liquid and vapor phases for liquid concentrations of ~1% by a method whose application requires no assumption about the equation of state of the mixture. From a series of filling curves at various temperatures and initial concentrations,

sufficient data have been obtained to give the dew point as a function of pressure, temperature, and vapor concentration. By using this data, the concentration of the vapor phase can be determined from the vapor pressure and temperature, and the liquid concentration then deduced by calculating the mass difference. The question of concentration equilibrium in the liquid and effect of Rollin film on the vapor phase is discussed.

3343

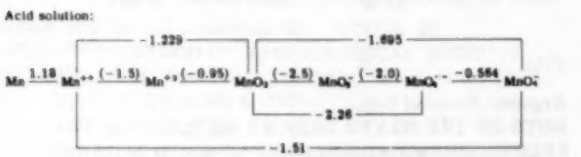
Sylvania Electric Products, Inc.
THE DECOMPOSITION COEFFICIENT OF ZIRCONIUM TETRAIODIDE. Robert B. Holden and Bernard Kopelman. Mar. 27, 1951. 24p. (SEP-58(X))

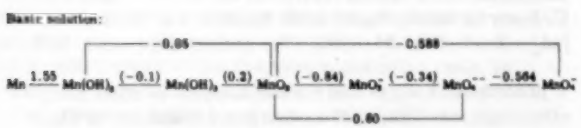
An abstract of this report has been issued and indexed as report AECU-1115, which appeared in its entirety in Nuclear Science Abstracts as NSA 5-961.

3344

Radiation Lab., Univ. of California
THE HEAT OF OXIDATION OF MANGANOUS ION TO PERMANGANATE AND THE MANGANESE POTENTIALS. Z. Z. Hugus and W. M. Latimer. Jan. 1951. 9p. (UCRL-1088)

Recent work on the $Mn - Mn^{++}$ and $Mn^{++} - MnO_2$ couples has done much to clarify the thermodynamics of the various oxidation states of Mn, and it now appears definite that cell measurements on the $Mn^{++} - MnO_2$ and $MnO_2 - MnO_4^-$ couples are reliable and reproducible when the MnO_2 is in the form of pyrolusite, prepared by heating $Mn(NO_3)_2$. In order to confirm this and to bring the thermal data into line with the measured potentials, the heat of the reaction $MnO_4^- + \frac{1}{2}H_2 + 3H^+ = Mn^{++} + 4H_2O$ has been redetermined. This heat, $\Delta H = -196.71 \pm 0.23$ Kcal, and the entropy values have been employed to calculate the potential. The potential diagrams relating all the oxidation states of Mn in uncomplexed solutions are given as follows:





3345

Radiation Lab., Univ. of California
THE HEAT OF OXIDATION OF GERMANOUS IODIDE AND THE GERMANIUM OXIDATION POTENTIALS. W. L. Jolly and W. M. Latimer. Mar. 1951. 8p. (UCRL-1152)

No thermodynamic properties have been determined previously for any +2 Ge species. The germanous ion cannot be studied directly because no Ge(II) species exists in any appreciable concentration in noncomplexing aqueous solutions. GeI_2 was chosen as a reference +2 compound because it is easily prepared and is stable in dry air. The present report deals only with the experimentation designed to measure the heat of oxidation of $GeI_2(s)$ to germanic acid in aqueous solution. By estimating entropies it is then possible to obtain $E^\circ = +0.23 \pm 0.04$ volt as oxidation potential for the couple: $GeI_2(s) + 3H_2O = H_2GeO_3 + 4H^+ + 2I^- + 2e^-$. A potential diagram for Ge, GeI_2, GeO_2, and H_2GeO_3 in acid solution is given, but it does not lead to correct predictions of chemical behavior. Germanous iodide is slightly soluble in both water and $HClO_4$ solutions, and until further work is done on the measurement of the solubility product, it will be impossible to evaluate the corresponding potential involving germanous ion.

3346

THE CHEMISTRY OF RUTHENIUM. PART V. THE POTENTIAL OF THE BIVALENT/TRIVALENT RUTHENIUM COUPLE IN HYDROCHLORIC ACID. J. R. Backhouse and F. P. Dwyer. J. Proc. Roy. Soc. N. S. Wales 83, 146-9(1950) Sept. 26.

The potential of the bivalent/trivalent Ru couple in HCl was found to be 0.084 ± 0.005 volts in the HCl range of concentrations 1.53N to 6.8N. It is considered that the system is cationic with the ionic species $(RuCl_2)^+$ and $(RuCl)^+$ for the oxidant and reductant, respectively. From the potential values and the behavior of the system in low acid concentrations, it is concluded that Grube and Nann's (Z. Electrochem. 45, 871(1939)) alleged univalent Ru is really bivalent Ru. (auth)

3347

HALOGEN EXCHANGE BETWEEN THE CHLORIDES AND BROMIDES OF GROUP IV ELEMENTS. Marie-Louise Delwaulle. Compt. rend. 232, 54-6(1951) Jan. 3. (In French)

Some qualitative observations on the course of halogen exchange, as followed by Raman spectrography, between $GeCl_4$ and $GeBr_4$, $GeCl_4$ and $GeHBr_3$, and $SnBr_4$ and $GeCl_4$ or other tri- and tetra-chlorides and bromides of Ti, Ge, and Sn are presented.

3348

ION EXCHANGE RESINS. Robert Kunin and Robert J. Myers. New York, John Wiley & Sons, Inc., 1950 212p.

A unified and comprehensive account of ion exchange resins is given. A more complete survey of this book is presented in a book note in Nucleonics 8, No. 4, 76-7(1951) Apr.

3349

KINETICS OF PYROLYSIS OF DIBORANE. John K. Bragg, Lewis V. McCarty and F. J. Norton. J. Am. Chem. Soc. 73, 2134-40(1951) May.

The kinetic studies of the thermal decomposition of diborane reported are of three kinds: the rate of increase of total pressure has been measured as a function of temperature

and initial pressure, the rate of formation of H_2 has been measured, and the mass spectrometer has been used to follow the reaction. It is concluded that the order of the step controlling the rate of disappearance of diborane is 1.5, that dihydropentaborane (B_5H_{11}) is an intermediate in the formation of most other boranes from diborane, and that the formation of pentaborane (B_5H_9) from dihydropentaborane is probably a simple first-order step. The reaction scheme $B_2H_6 \rightleftharpoons 2BH_3$; $B_2H_6 + BH_3 \rightarrow$ intermediate products; intermediate products + $B_2H_6 \rightarrow B_5H_{11} + 2H_2$; $B_5H_{11} \rightarrow B_5H_9 + H_2$; $B_5H_{11} \rightarrow B_2H_6$ and higher hydrides accounts satisfactorily for the observations of the mass spectrometer. The equations derived from it also account for the observed H_2 pressure data and for observed total pressure data, provided certain assumptions are made.

3350

THE LUMINOUS REACTION OF PENTABORANE AND OXYGEN AT AND BELOW THE FIRST PRESSURE LIMIT OF EXPLOSION. Fraser P. Price. J. Am. Chem. Soc. 73, 2141-4(1951) May.

The reaction of pentaborane with O_2 at room temperature in spherical pyrex bulbs has been investigated. Below the first explosion limit a bluish light is emitted, the time dependence of which is described by $-dI/dt = kI^2$, where I is light intensity and k a constant. This constant increases with increasing pentaborane pressure but decreases with increasing O_2 pressure. The first explosion limit can be expressed by $P_{O_2} \times P_{B_5} - 3.36P_{B_5}/r - 1.92/r = 0$, where the P's represent pressures and r is the radius of the spherical bulb. The types of reaction schemes necessitated by the explosion limit and luminous reaction data are presented and discussed. (auth)

3351

ON THE COMPLEX FORMATION BETWEEN THORIUM AND ACETYLACETONE. Jan Rydberg. Acta Chem. Scand. 4, No. 10, 1503-22(1950).

The complexes of Th^{+4} and acetylacetone (HAa) in aqueous solution have been investigated by measuring the distribution of tracer amounts of Th^{234} between benzene and aqueous solutions of various Aa- concentrations. The measurements have been performed at 25°C and at an approximately constant ionic strength of 0.01 which was brought about by adding $HClO_4$ and NaOH. The hydrolysis of Th^{+4} was found to be negligible, and no polynuclear complexes seemed to be formed at these low concentrations. The results could be explained only by assuming that all complexes, $ThAa^{+3}$, $ThAa_2^{++}$, $ThAa_3^{+}$, and $ThAa_4$, exist. The constants for the step by step addition of Aa^- to Th^{+4} and those for the over-all addition were calculated by two independent methods, and consistent results were obtained. The distribution constant of $ThAa_4$ between benzene and water was found to be $\lambda_4 = 315 \pm 30$. (auth)

3352

A PRELIMINARY STUDY OF THE KINETICS OF PYROLYSIS OF DIBORANE. Richard P. Clarke and Robert N. Pease. J. Am. Chem. Soc. 73, 2132-4(1951) May.

The kinetics of pyrolysis of diborane have been studied between 85 and 163°C. The fractional rate appears to be proportional to the square root of the initial pressure (indicating a free-radical mechanism) times the ½ power of the fraction of diborane unreacted, and is depressed by addition of H_2 but unaffected by an equivalent amount of N_2 or by an increase in surface. The reaction is believed to be a radical-type polymerization process complicated by quasi-reversible dehydrogenation. (auth)

ANALYTICAL PROCEDURES

3353

Argonne National Lab.
A VOLUMETRIC METHOD FOR THE DETERMINATION OF ACID IN SOLUTIONS CONTAINING URANYL NITRATE. (Based on CN-1449, p.5-10.) W. H. Johnston and P. L. Kirk. [nd] Decl. Mar. 20, 1951. 7p. (AECD-3107; ANL-HDY-573)

The acid is determined in the presence of uranyl nitrate by a drop-scale (μl) quinhydrone potentiometric titration with NaOH. The end point is defined by the equivalence potential of a reference half cell containing a synthetic stoichiometric solution. (auth)

3354

Argonne National Lab.
THE ELECTRO-REDUCTION OF URANIUM AND EXTRACTION WITH ETHER. (Based on CC-1551.) R. E. Fryxell and L. W. Safranski. [nd] Decl. Mar. 26, 1951. 8p. (AECD-3119; ANL-HDY-565)

The electrolytic reduction of U(VI) to U(IV) in HCl solution is described. Ether will quantitatively extract 1-mg amounts of U as uranous cupferrate from aqueous solution. A double extraction will satisfactorily remove as much as 30 mg. The method can be used to separate milligram quantities of U prior to a determination of the U, or to remove the interference of U when analyzing for various elements by spectrographic or other means. (auth)

3355

Argonne National Lab.
NOTE ON THE SILVER BRIQUET METHOD FOR THE SPECTROCHEMICAL ANALYSIS OF SOLID SAMPLES. (Based on CC-1831; CC-1971; and CC-2237.) Irene Corvin, C. Lothrop Smith, Raymond G. Russell, and Mark Fred. [nd] Decl. Mar. 27, 1951. 7p. (AECD-3124; ANL-HDY-583)

A procedure is suggested for the analysis of solid samples other than metallic, such as inorganic residues, in which maximum accuracy is desired with no great sensitivity: the finely ground sample is mixed with an excess of metallic powder, briquetted, and sparked. Ag seems to be the best metal for ease of briquetting, chemical purity, and minimum spectrum interference. As little as 50% Ag makes a briquet which holds together, but briquets made of 99% silver have better sparking characteristics and better machinability if the latter is required. The possibility of developing this method into a universal procedure, applicable to any sample regardless of composition, i.e., a procedure in which the intensity calibration for a given ele-

ment in terms of amount present would be independent of variable amounts of other elements in the sample, was considered. Experiments were performed with Ag briquettes containing 1% of standard mixtures of Fe_2O_3 and Al_2O_3. Changes in intensities of the Fe lines gave a straight-line working slope, but Al intensities varied greatly with the nature of the mixture. Addition of BaF_2 and use of a critically damped discharge reduced the differences between compounds and improved excitation and reproducibility, but it appeared unlikely that hopes for a universal method would be easily realized. It would appear that the silver-briquette method is most useful for samples of controlled composition.

3356

Argonne National Lab.
THE DETERMINATION OF TOTAL ACID ON THE DROP SCALE. (Based on CN-2235, p.31-6.) L. W. Safranski and M. E. Jackson. [nd] Decl. Mar 27, 1951. 7p. (AECD-3127; ANL-HDY-576)

A rapid titrimetric method is presented for the determination of total acid in mixtures of HF, HNO_3, and H_3PO_4 on the drop scale, i.e., the volume of standard reagent used in a titration will very roughly approximate one drop or 50 μl. (auth)

3357

Argonne National Lab.
IODOMETRIC DETERMINATION OF IODINE IN HEAVY METAL IODIDES. (Based on CK-1763, p.10.) M. J. Wolf. [nd] Decl. Mar. 28, 1951. 9p. (AECD-3128; ANL-HDY-505)

A distillation-absorption method of analysis for I in heavy metal iodides, capable of estimating from 50 to 800 μg of I^- ion to within a few per cent is described.

3358

Carbide and Carbon Chemicals Div., UCC, K-25
A MODIFIED METHOD OF RADIOCHEMICAL ACTIVITY ANALYSIS. F. S. Voss. Feb. 13, 1951. Decl. Mar. 27, 1951. 15p. (AECD-3132; K-717)

A modification of existing methods of radiochemical activity analysis has been developed. This modification makes more rapid analysis possible when a large number of somewhat similar activity analyses are required. A correction factor, which corrects for the loss in chemical yield, is determined once for each procedure and is used for all similar analyses instead of a gravimetrically determined factor for each analysis. (auth)

3359

Mineral Engineering Lab., Mass. Inst. of Tech.
MODIFICATIONS IN THE PEROXIDE-COLORIMETRIC METHOD FOR URANIUM DEVELOPED AT THE MIT MINERAL ENGINEERING LABORATORY. David Kaufman and Paul Galvanek, Jr. July 1, 1950. Decl. Apr. 11, 1951. 19p. (AECD-3137; MITG-A67)

Tests of the effect of variations in procedure of the peroxide-calorimetric method for U and the effect of Fe and Cr have been carried out. In general, it was found that, although no single variable was critical, close attention to a given procedure was needed for good results. In the conventional peroxide-colorimetric method, ether extraction was used to separate U from other elements. A modified ether extractor has been developed which permits roasting, leaching, and extracting in the same container, thus eliminating two transfer steps, filtration and washing and evaporation. The modified procedure makes it possible for one person to complete 12 determinations in an 8-hr day. A comparison of results obtained on samples by the modified and the conventional procedure is made.

3360

Knolls Atomic Power Lab.
DETERMINATION OF MICROGRAM AMOUNTS OF CALCIUM AND MAGNESIUM IN VANADIUM METAL.
J. Rynasiewicz, R. Guenther, M. E. Sleeper, and R. H. Gale. [nd] 5p. (AECU-1231)

Vanadium was precipitated from an acid solution with cupferron, and the cupferride was then extracted with chloroform. Calcium and magnesium were determined in the aqueous phase as calcium oxalate and magnesium ammonium phosphate according to the method described by Marsden (J. Soc. Chem. Ind. (London) 60, 21(1941)).

3361

Ames Lab.
SPECTROPHOTOMETRIC DETERMINATION OF NICKEL WITH VIC-DIOXIMES. Raymond Craig Ferguson. June 5, 1950. 78p. (ISC-93)

The literature on the colorimetric, photometric, and spectrophotometric determination of Ni has been surveyed. The more commonly used reagents are discussed, and references to the important papers in the field are included. The general characteristics of the Ni–dioxime complexes which form in the presence of strong oxidizing agents have been studied. Three vic-dioximes have been reacted with Ni under strongly oxidizing conditions, and their absorption spectra have been compared. The application of these reactions to colorimetry is discussed. The applicability of the red nickelous nioxime complex to the colorimetry of Ni has been studied spectrophotometrically. The absorption spectrum, stability, sensitivity to pH, obedience of Beer's law, and interferences are discussed. A procedure for the determination of Ni in Ca metal is recommended. (auth)

3362

Oak Ridge National Lab.
THE DETERMINATION OF RADIONIOBIUM IN THE PRESENCE OF SOLUBLE ORTHOPHOSPHATES.
R. B. Hahn and C. L. Burros. Mar. 15, 1951. Decl. Apr. 10, 1951. 8p. (ORNL-831)

A step-by-step procedure for the determination of Nb in the presence of PO_4^{-3} ions is presented. This procedure avoids

the erratic results of other methods, which are caused by coprecipitation of the phosphate with the final Nb_2O_5 precipitation by an initial precipitation of $Nb(IO_3)_5$ from concentrated HIO_3 solution. Coprecipitation of iodate and phosphate is in the ratio of their concentrations in solution. Results from the new procedure usually run 3 to 5% low due to the retention of small amounts of P_2O_5 in the final precipitate.

3363

Oak Ridge National Lab.
SPECTROPHOTOMETRIC DETERMINATION OF INORGANIC FLUORIDES. A. D. Horton, P. F. Thomason, and F. J. Miller. Mar. 26, 1951. Decl. Apr. 10, 1951. 14p. (ORNL-839)

A spectrophotometric method for the determination in inorganic compounds of fluoride ion in the range 0 to 50 μg has been developed. The method is dependent on the fact that fluoride ion diminishes the red color which is produced when "thoron" reagent (1-arsonophenyl-azo)-2-napthol-3, 6-disulfonic acid) is added to a standard $Th(NO_3)_4$ solution. The fluoride ion is recovered by steam distillation of a $HClO_4$ solution of the sample between 125 and 135°C in a modified Willard-Winter still. Al and P, the principal interfering ions, are retained in the distillation flask.

3364

ANALYTICAL CHEMISTRY OF THORIUM. PART III. SEPARATION FROM CERITE EARTHS WITH o-TOLUIC ACID AND ACETYLSALICYLIC ACID. B. R. Lakshmana Rao and Bh. S. V. Raghava Rao. J. Indian Chem. Soc. 27, 569-72(1950) Oct. (See also NSA 5-1221)

From solutions just neutral to Congo red, o-toluic acid precipitates Th quantitatively and also affords a method of separating the cerite earths if the amount of the latter is not higher than tenfold that of the Th. The pH of the solution, which is not critical, falls between 3 and 4. Acetylsalicylic acid exhibits a similar behavior, but the presence of ammonium acetate is necessary. When the $ThO_2 : R_2O_3$ ratio is not greater than 5, double precipitation is necessary. The pH of the liquid in this case lies between 4 and 4.4. Both the reagents have been employed for the estimation of Th in monazite. (auth)

3365

ANALYTICAL CHEMISTRY OF THORIUM. PART IV. SEPARATION FROM URANIUM. T. K. S. Murthy, B. R. Lakshmana Rao, and Bh. S. V. Raghava Rao. J. Indian Chem. Soc. 27, 610-12(1950) Nov.

Separation of Th from U by the classical oxalic acid method is not satisfactory in that the ignited oxide is slightly colored. Double precipitation by m-nitrobenzoic acid or by o-chlorobenzoic acid was shown to give highly satisfactory results in the presence of U in concentration 50 to 60 times that of the Th. (auth)

3366

Atomic Energy Research Establishment, Harwell, Berks. (England).
FLAME PHOTOMETRIC ANALYSIS. K. Saddington, W. Fullwood, and A. A. Smales. Dec. 1950. 21p. (AERE-C/R-644)

The use of the flame photometer as an analytical instrument is discussed, and descriptions are given of the Beckmann model and of an instrument constructed at Harwell by the authors. Difficulties encountered in the use of the flame photometer when applied to the analysis of complex solutions are described, with suitable techniques designed to overcome these difficulties. Comprehensive references are given to the application of this instrument to a wide range of problems. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

3367

Los Alamos Scientific Lab.
OPTICAL AND X-RAY DATA ON A GROUP OF ISOSTRUCTURAL URANIUM AND PLUTONIUM COMPOUNDS. Eugene Staritzky and Joseph Singer. [nd] Decl. Feb. 26, 1951. 20p. (AECD-3071; LADC-953)

A group of isostructural compounds of hexavalent and tetravalent U and Pu with the tetraethyl and tetramethyl ammonium chloride (types = $(R_4N)_2 MCl_6$ and $(R_4N)_2 MO_2Cl_4$) have been characterized by their optical properties and by x-ray diffraction analysis. Some errors in earlier data have been corrected and explained. The isostructuralism is maintained throughout the group as evidenced by both crystal morphology and x-ray crystallography. Space groups range from cubic to monoclinic. A monoclinic crystal has a β angle of 90.0 deg. The effect of substitutions of Pu for U, UO_2 for U, C_2H_5 for CH_3 on molar refractivities are reported. (auth)

3368

Cornell Univ.
STRUCTURES OF FLUOROCARBONS, ELEMENTARY BORON, AND BORON COMPOUNDS. J. L. Hoard. Jan. 1, 1951. 7p. (NYO-716)

An approximately correct but somewhat idealized structure has been found for a tetragonal modification of elementary B. The structure consists of regular icosahedral groups of B atoms linked together to give a continuous three-dimensional network. There are four such groups, each of 12 atoms, within the unit cell. Two additional atoms in specialized positions are required to give the correct total of 50/unit, as indicated by the density, and to make the three-dimensional network of bonds entirely complete. Every B atom of an icosahedral group shows sixfold coordination with bonds directed toward the corners of a pentagonal pyramid (as in the structure of boron carbide). The two atoms occupying specialized positions show fourfold tetrahedral coordination. (auth)

3369

Oak Ridge National Lab.
THE CRYSTAL STRUCTURE OF UAl_4. Bernard S. Borie, Jr. Sept. 15, 1950. 14p. (ORNL-810)

The aluminum-rich U-Al intermetallic compound has the formula UAl_4. Its unit cell is body-centered orthorhombic, a = 4.41, b = 6.27, and c = 13.71 A. The cell contains four formula weights, and the space group is either Ima or Imma. The atoms occupy the following positions of Imma:

		(0) 0 0; ½ ½ ½) +	
4 U	in	(e)	$0\,\frac{1}{4}\,z;\ 0\,\frac{3}{4}\,\bar{z};\ z/c = 0.111$
4 Al	in	(e)	$0\,\frac{1}{4}\,z;\ 0\,\frac{3}{4}\,\bar{z};\ z/c = -0.111$
4 Al	in	(b)	$0\,0\,\frac{1}{2};\ 0\,\frac{1}{2}\,\frac{1}{2}$
8 Al	in	(h)	$0\,y\,z;\ 0\,\bar{y}\,\bar{z};\ y/b = -0.033;\ z/c = 0.314$
			$0,\ \frac{1}{2} + y,\ \bar{z};$
			$0,\ \frac{1}{2} - y,\ z$

The number and kinds of nearest neighbors and the interatomic distances for the various atoms in the unit cell are given. The chemical analyses and density measurements, which are somewhat inconsistent with the ideal structure, may be explained by assuming either that some U sites are unoccupied or that some are occupied by Al atoms.

3370

AN ANALYSIS OF THE ELECTRON DIFFRACTION DATA FOR DECABORANE. Charlys M. Lucht. J. Am. Chem. Soc. 73, 2373-5(1951) May. (Note)

Electron-diffraction intensity curves have been calculated, using the data of Silbiger and Bauer (J. Am. Chem. Soc. 70, 115(1948)), for a decaborane model not previously considered. This model, the bond distances of which have been determined from x-ray-diffraction data, has the symmetry m m 2. The B atoms are at 10 of the vertices of a somewhat distorted regular icosahedron, two neighboring vertices of which are unoccupied. The resulting arrangement forms two regular pentagonal pyramids with a common edge, and an angle of 76 deg between the base planes of the pyramids. Each of 10 H atoms is attached to a single B atom in the direction of a fivefold axis of the icosahedron. The remaining 4 H atoms each bridge 2 B atoms. Better agreement with experiment is shown than for any other model yet considered.

3371

THE CRYSTAL STRUCTURE OF DECABORANE, $B_{10}H_{14}$. J. S. Kasper, C. M. Lucht, and D. Harker. Acta Cryst. 3, 436-55(1950) Nov.

The crystal structure of decaborane has been determined from x-ray diffraction data. Crystals prepared by sublimation at room temperature, or above, show a high degree of polysynthetic twinning, giving rise to diffuseness of reflections for which h and k are odd. In the untwinned condition, the crystal is monoclinic, but pseudo-orthorhombic, and it is convenient to choose the twofold axis in the c direction. The space group is then $C112/a-C_2^4$. With a_0 = 14.45, b_0 = 20.88, c_0 = 5.68 A, β = 90.0 deg, the cell contains 8 molecules of $B_{10}H_{14}$, and the calculated density is 0.96 g cm^{-3}. The individual crystals that make up the actual, highly twinned crystalline edifice are so short in the b direction (a few unit translations) that it is convenient to consider the system as a partially ordered crystal the disordered state of which is described by a unit cell one-quarter the size of the one mentioned above. The dimensions of this small cell are a_0' = 7.225, b_0' = 10.44, c_0' = 5.68 A, and it contains $2B_{10}H_{14}$ or $(\frac{1}{2}B)_{20}$ $(\frac{1}{2}H)_{28}$. The disordered structure based on this cell explains all the sharp spots observed — its space group is Pnnm-D_{2h}^{12}. The solution of the structure resulted from a successful application of phase inequalities in obtaining an approximate projected structure (on (001)). The application of the inequalities is discussed in some detail. The refinement of parameters has been accomplished by means of Fourier methods, including several three-dimensional syntheses. Hydrogen atoms are resolved, and all 14 of them in the molecule have been located from the electron-density maps. The molecule is required by the space group to have only a twofold axis but appears to have two mirror planes as well; it has the symmetry m m 2. The boron atoms are at 10 of the vertices of a somewhat distorted regular icosahedron, two neighboring vertices of which are unoccupied. The resulting arrangement forms two regular pentagonal pyramids with a common base edge. The angle between the base planes of those pyramids is 76°. Each of 10 hydrogen atoms is attached to a single boron atom in the direction of a fivefold axis of the icosahedron. The remaining four hydrogens each bridge two boron atoms. This structure is interpreted in terms of resonating single bonds, such as used by Pauling in describing metallic binding. (auth)

3372

CRYSTALLOGRAPHIC ANISOTROPY OF THE DE HAAS-VAN ALPHEN EFFECT; trans. from Doklady Akad. Nauk S.S.S.R. 73, No. 1, 59-62. B. I. Verkin, B. G. Lazarev, and N. S. Rudenko. Mar. 30, 1950. (NP-2255)

New peculiarities of the de Hass-van Alphen effect in Zn have been established through an investigation into the anisotropy of magnetic properties in the basic plane of Zn monocrystals. Zn and Be monocrystals have been studied at low temperatures of liquid H in fields of 3000 to 14,500 oersteds. The difference of susceptibilities has been measured relative to the force couple acting on a crystal suspended by a thin elastic filament in a homogeneous field. Results are discussed. Conversion diagrams are shown and interpretations are made. Previous experimental investigations of monocrystals by the authors and others are discussed.

DEUTERIUM AND DEUTERIUM COMPOUNDS

3373

Brookhaven National Lab.
REACTION OF DEUTERIUM WITH HYDROCARBONS OVER A COBALT THORIA FISCHER-TROPSCH CATALYST. Sidney O. Thompson, John Turkevich, and Adolph P. Irsa. [nd] 12p. (AECU-1206)

Deuterium was found to exchange with ethane, propane, butane, and isobutane when a mixture of six volumes of deuterium and one volume of each of the hydrocarbons was passed over a Fischer-Tropsch cobalt catalyst under conditions of temperature and flow rate similar to these of hydrocarbon synthesis. The exchanged products were found to be extremely deuterated and the amount of exchange was less than 10% in the case of the ethanes and propanes, 45% for n-butane, and 51% for isobutane. Cracking of the hydrocarbon gases to produce deuterated methane was also observed. (auth)

FLUORINE AND FLUORINE COMPOUNDS

3374

Argonne National Lab. and Kedzie Chemical Lab., Michigan State Coll.
FLUORINE EXCHANGE REACTIONS BETWEEN HYDROGEN FLUORIDE AND THE HALOGEN FLUORIDES.
Max T. Rogers and Joseph J. Katz. Feb. 16, 1951. 18p. (AECU-1251; UAC-360)

The exchange of radioactive F^{18} between HF and various halogen fluorides has been studied in both the liquid and vapor phase in metal apparatus. Certain related exchange reactions have been investigated and convenient methods are described for counting radioactive F in the form of gaseous fluorides. The exchange reactions between HF and the liquid interhalogen compounds BrF_3, ClF_3, BrF_5, and IF_5 were found to be essentially complete at room temperature with a contact time of 10 min. The exchange reactions between HF and gaseous ClF_3, BrF_5, and IF_7 are essentially complete in a contact time of 3 min at room temperature and atmospheric pressure, whereas the exchange between HF and SF_6 or CCl_2F_2 and between ClF_3 and F_2 is essentially zero. The mechanism of the liquid- and gas-phase reactions is discussed briefly. Although an atomic mechanism for the gas-phase reactions cannot be excluded, a mechanism involving formation of relatively stable intermediate complexes appears to be more satisfactory. (auth)

3375

IONIZATION CONSTANTS OF FLUORINATED ACIDS.
Albert L. Henne and Charles J. Fox. J. Am. Chem. Soc. 73, 2323-5(1951) May.

Perfluorinated acetic and butyric acids are strong electrolytes. $CF_3CH_2CO_2H$ and $CF_3(CH_2)_2CO_2H$ are weak electrolytes with ionization coefficients of 1×10^{-3} and 7×10^{-5}, respectively; their unfluorinated analogs have coefficients of only 1.3×10^{-5} and 1.5×10^{-5}, respectively. The shielding effect of one methylene group between the fluorinated cluster and the acid function is considerable, but even two methylene groups do not achieve complete shielding; this emphasizes the magnitude of the electronegative induction exerted by CF_3 groups. (auth)

3376

Imperial Chemical Industries, Ltd., Widnes
THE PRODUCTION OF FLUORINE; SOME NOTES ON ANODE PHENOMENA OCCURRING IN THE MEDIUM TEMPERATURE FLUORINE CELL. A. J. Rudge. [nd] 6p. (NP-1985)

A discussion is presented of the nonwetting effect at the carbon anode in the electrolysis of KF.2HF, the effects of electrode/electrolyte contact angle on bubble formation, formation of a gas sheath on the carbon anode, the hollow anode, and the phenomenon of polarization. 18 references.

GRAPHITE

3377

I. THE EXISTENCE OF A GRAPHITE – MANGANESE SULFIDE AZEOTROPE. DEPOLYMERIZATION AND IONIZATION OF CARBON. II. FORMATION OF A CARBON – MANGANESE SULFIDE ASSOCIATION. Marius Picon and Jean Flahaut. Bull. soc. chim. France (5) 17, 1070-5(1950) Nov.-Dec. (In French)

Graphite and MnS have been found to sublime at 1375°C when heated together. Since this temperature is 900°C below the normal sublimation temperature of carbon in 0.001 cm Hg vacuum, the existence of an azeotrope between sublimable substances has been demonstrated for the first time. Elevation of the temperature appears to diminish the proportion of carbon in the azeotrope. The action of an electric field indicates that the azeotrope contains ionized carbon. Following condensation, physical and chemical properties of the resulting metalloid were found to differ from those of the original substances.

LABORATORIES AND EQUIPMENT

3378

Argonne National Lab.
THE DEVELOPMENT AND APPLICATION OF CAPILLARY ABSORPTION CELLS. (Based on CN-2235, p.76-83.)
R. S. Rosenfels, P. L. Kirk, R. E. Kitson, R. L. Patton, and R. E. Curtis. [nd] Decl. Mar. 26, 1951. 13p. (AECD-3117; ANL-HDY-551)

Various types of capillary absorption cells have been constructed from a variety of materials. These cells, having volumes as low as 160 μl, have been used to increase the sensitivity of several colorimetric methods as much as 1000-fold without appreciable loss of accuracy. Small volumes of solution must be used in order to concentrate the colored material present. (auth)

3379

[Ames Lab.]
MICRO-PIPETTE REMOTE CONTROL. J. Weber, Jr. and E. Dewell. July 20, 1950. 5p. (ISC-112)

A micropipet remote-control mechanism was developed to satisfy the need for handling small quantities of extremely radioactive materials. Quantities as small as 5 μl had to be delivered with the assurance that accuracy of measurement was maintained. Ease of operation was also an element considered in the production of this mechanism. A typical setup consists essentially of the remote-control panel which supports the observation telescope, the control cables which link the panel to the pipet mechanism proper, and the necessary shielding.

3380

North American Aviation, Inc.
A SMALL HIGH TEMPERATURE VACUUM FURNACE FOR LABORATORY USE. C. A. Smith. Apr. 10, 1951. 14p. (NAA-SR-109)

A vacuum furnace with a capacity of about 5 cc has been built to cover the range from room temperature to about 2300°C. A helical graphite heater is employed. The furnace is rugged, simple to construct, and easy to use. It requires about 700 watts at 2000°C. 7 figures. (auth)

3381

Atomic Energy Research Establishment, Harwell, Berks. (England)
AN IMPROVED TYPE OF MICRO-CELL CARRIAGE FOR THE HILGER "SPEKKER" PHOTOELECTRIC ABSORPTIOMETER MODEL H.560. C. Sanders and A. W. Elson. Dec. 1950. 8p. (AERE-Med/R-621)

Mechanical details of a three-microcell carriage and a single-microcell carriage are detailed. Results of a series of readings of a colored solution taken in the three types of carriage are given.

3382

Atomic Energy Research Establishment, Harwell, Berks. (England)
A VALVE FOR GLASS BLOWING ON APPARATUS CONTAMINATED WITH RADIO ACTIVE OR TOXIC SUBSTANCES. F. T. Birks. Feb. 1951. 4p. (AERE-C/M-97)

An apparatus for control of internal gas pressure of glassware during blowing operations has been devised for working glass systems in which the presence of toxic or radioactive materials makes control by the mouth undesirable. The apparatus is worked by foot pressure, leaving the hands free. Its function is to admit air at a controlled rate into the glass system from the compressed-air line and to release the air pressure instantly when desired.

RADIATION EFFECTS

3383

Atomic Energy Project, Univ. of California, Los Angeles
THE RADIATION CHEMISTRY OF CYSTEINE SOLUTIONS; PART I. Mary Rotheram, Norman Todd, and S. L. Whitcher. Mar. 28, 1951. 39p. (UCLA-119)

Quantitative experiments have been made to determine the chemical changes which take place in dilute aqueous solutions of cysteine during exposure to x rays. The thiol group is oxidized at a rate which depends on the pH and concentration of the solutions and which, for alkaline solutions, is greatly influenced by the presence of dissolved air. A minimum is found in the oxidation around pH 4 and a maximum around pH 9. Accompanying the oxidation there are small amounts of H_2O_2 and H_2S formed in the solutions. At acid pH and with dissolved air present, the peroxide formation is somewhat greater than in pure water, whereas at alkaline pH it drops to a low value. The production of H_2S is increased considerably by removal of air but does not appear to be very sensitive toward changes in pH. Under certain conditions of pH and concentration the ionic yield with respect to the oxidation of cysteine rises greatly above that which can be explained on the basis of ionization alone. (auth)

3384

Radiation Lab., Univ. of California
SUMMARY OF THE RESEARCH PROGRESS MEETING OF DECEMBER 21, 1950. R. K. Wakerling. Mar. 12, 1951. 4p. (UCRL-1175)

Radiation Chemistry of Alcohols. Yields in molecules of product formed per 100 ev when methanol, ethanol, n-propanol, isopropanol, and tert-butanol were bombarded with 28-Mev α particles are tabulated and discussed briefly. The hydrogen on the carbon to which the hydroxyl is attached is indicated to be especially susceptible to attack. Angular Distribution of Neutrons. The spatial distribution of neutrons produced by the impact of deutrons of maximum energy 20 Mev on fixed targets of Al, Be, Cu, Sn, Pb, and U has been investigated using the 60-in. cyclotron. No data are given.

RARE EARTHS AND RARE-EARTH COMPOUNDS

3385

Wisconsin Univ.
RATES AND MECHANISMS OF OXIDATION REACTIONS INVOLVING CERIUM(IV); PROGRESS REPORT. [nd] 28p. (AECU-1229)

Spectrophotometric studies have been made in order to elucidate the hydrolysis equilibria involving Ce(IV) and in particular the question of the existence of dimeric species. Measurements of the absorption of light in the wavelength region 400 to 480 mμ indicate the presence in perchloric acid solution of species containing two Ce(IV) ions. The value of the equilibrium constant $K = (Ce_2^{IV})/(Ce^{IV})^2$ is 32 in 2.57M H^+, 3.00M ClO_4^-, and 36 in 0.85M H^+, 3.00M ClO_4^-. A constant of this magnitude corresponds to 55% of the Ce(IV) present as the dimer at 4.3×10^{-3}M Ce(IV) and 5% as dimer at 10^{-3}M Ce(IV). A study of complexes of Ce(IV) and sulfate has been made by spectrophotometric means. The spectra have been determined at 25°C of solutions of varying concentration of Ce(IV) but consistent concentrations of bisulfate, perchlorate, and hydrogen ions. In another series of experiments, the spectra of solutions of varying concentrations of bisulfide were determined. These data are tabulated. A preliminary correlation of the above data with the existence of several Ce(IV) sulfate complexes in solution has been made. It is seen that the adsorption spectra of solutions of Ce(IV) in the presence of bisulfate over the bisulfate concentration range 1.56×10^{-2} to 2.00M at 2.57M hydrogen ion indicate the existence of three Ce(IV) sulfate complexes. These three complexes have N, N − 1, and N − 2 sulfate ions (or bisulfate ions) per Ce(IV) where N is as yet undetermined.

3386

SPECTRA AND STRUCTURES OF CRYSTALLINE EUROPIUM SALTS. I. EUROPIUM CHLORIDE, $EuCl_3.6H_2O$. K. H. Hellwege and H. G. Kahle. Z. Physik 129, 62-84(1951) Jan. 29. (In German)

Owing to the sharpness of their spectrum, rare-earth salts are convenient objects for the investigation of interactions between orbits of atomic electrons in a crystal and the crystal lattice. These questions are studied using the absorption spectrum of $EuCl_3.6H_2O$. The spectroscopic method used is described, and the spectral data are tabulated. A quantum-mechanical interpretation of the results is given.

3387

SPECTRA AND STRUCTURES OF CRYSTALLINE EUROPIUM SALTS. II. EUROPIUM BROMATE, $Eu(BrO_3)_3.9H_2O$. K. H. Hellwege and H. G. Kahle. Z. Physik 129, 85-103(1951) Jan. 29. (In German)

The study of interactions between electronic energy levels and the crystal lattice is continued using the absorption spectrum of $Eu(BrO_3)_3.9H_2O$. (See also Z. Physik 129, 62(1951).)

SEPARATION PROCEDURES

3388

Ames Lab.
EFFECT OF FLOW RATES ON HOLDUP IN A LIQUID-LIQUID EXTRACTION SPRAY COLUMN FOR THE SYSTEM HEXONE-WATER. Howard Carl Peterson. May 31, 1950. 52p. (ISC-96)

A nozzle plate was designed for use in a spray column when the dispersed phase tends to wet the surface of the plate. This plate formed satisfactory drops and no wetting of the plate was observed for the hexone-water system. The use of a small number of holes in a nozzle plate tends to produce small drops and high holdup for low dispersed rates. Use of a larger number of holes in the plate produced larger and more equal drop size. Emulsions were practically nonexistent with a large number of holes. Emulsions and carryover were encountered with a small number of holes, with the system hexone-water. The effect of size of holes on holdup was quite noticeable if the number of holes in a plate was constant. In the two cases investigated, there was little effect of size of holes on holdup if the total hole area remained constant. It is possible to predict qualitatively drop-size distribution in a large column from the pressure drop across the nozzle plate. 18 figures. (auth)

3389

Oak Ridge National Lab.
THE SEPARATION OF YTTRIUM AND EUROPIUM WITH ANION EXCHANGE RESINS. C. E. Higgins and W. H. Baldwin April 3, 1951. 6p. (ORNL-894)

Mixed Y^{91} and Eu^{152} tracers in 0.5 ml of 0.16M versene at pH 11.7 were placed on top of the column of Dowex-1 resin (118 by 0.48 cm; 11.5 ml free column volume) and eluted with 0.16M versene at pH 11.7 by downward flow (0.2 $ml/cm^2/min$) at room temperature. The effluent was monitored continuously for activity, and identification of the elements in the peaks of activity was established by the use of absorption and decay curves. The peak of the Y activity occurred at 18 column volumes while that for the Eu occurred at 30 column volumes. This degree of separation is comparable to that found by elution from Dowex-50 resin columns with citrate buffer at pH 3.0 at room temperature and slightly less than that found at elevated temperatures.

3390

THE SEPARATION OF MONOSACCHARIDES BY ION EXCHANGE. Joseph X. Khym and Leonard P. Zill. J. Am. Chem. Soc. 73, 2399-400(1951) May. (Communication to the editor)

The biosynthetic preparation of C^{14}-labeled sugars requires a method for the separation of individual monosaccharides from their mixtures. Borate ion reacts with sugars to produce negatively charged sugar-borate complexes, and such sugar-borate complexes are separable by the technique of ion exchange. It was found that fructose, glucose, mannose, and galactose, dissolved in weak sodium borate solutions, are quantitatively adsorbed on strong-base anion exchangers.

SORPTION PHENOMENA

3391

Corrosion Research Lab., Univ. of Texas
REPORT FOR PERIOD SEPTEMBER 1, 1949, TO AUGUST 31, 1950. 1950. 77p. (NP-1859)

Exchange Adsorption. Solutions containing radioisotope-labeled chromate, sulfate, and chloride have been prepared in essentially pure form and are being used to determine the relation of anion adsorption at a metal surface and its dissolution tendency. Adsorption isotherms of chromate and sulfate on chromium have been found which show that maximum chromate adsorption is approximately 50 times greater than for sulfate. A method for the rapid determination of the surface area of metal coupons has been investigated and found applicable to nonnoble metals. Effects of Adsorption of Gases on the Reactivity of Metal Powders. The adsorption isotherms for O_2 and CO on reduced stainless steel, nickel, and molybdenum powders were obtained at room temperature. The surface area for stainless steel estimated from the CO adsorption isotherm was in fair agreement with the BET value. Reactivities measured in terms of rate of hydrogen evolution relative to that for reduced stainless steel, nickel, and chromium powders in either dilute hydrochloric or sulfuric acid under vacuum were determined. Adsorption of Polar Organic Compounds on Steel Surfaces. The adsorption of a number of compounds from benzene solutions onto steel powder has been carried out at 30 and 60°C. The amount of total and of irreversible sorption was determined over the concentration range 0.000375M to 0.015M. The effect of the adsorbed compounds on the activity of the steel was determined by measuring the rates of hydrogen evolution from aqueous HCl. A method was developed for determining the extent of adsorption from solutions onto planar surfaces by radiotracer techniques. Contact Potentials of Evaporated Iron Films as a Function of Air Pressure. The variation of contact potential with time for metal surfaces prepared by the evaporation process has been measured in vacuum and at low oxygen and nitrogen pressures.

SPECTROSCOPY

3392

Brookhaven National Lab.
THE ABSORPTION SPECTRA OF SOLUTIONS OF CHLOROPHYLL a AND OF CHLOROPHYLL b AT THE TEMPERATURE OF LIQUID NITROGEN. Simon Freed and K. M. Sancier. [nd] 7p. (AECU-1190)

New structural features of chlorophyll a and b have been observed in a study of their absorption spectra obtained by means of a Cary double-beam spectrometer at 230 and 77°K. Chlorophyll a exhibits new bands with maxima at 7200 and 7700 A, having no corresponding maxima at room temperature. Chlorophyll b shows new bands with maxima at 7000, 6300, and 4900 A and the unmistakable existence of four bands at 77°K at 3900, 3700, 3500, and 3200 A.

SYNTHESES

3393

Los Alamos Scientific Lab.
MICRO SYNTHESES WITH TRACERS ELEMENTS; XXVI. THE SYNTHESIS OF CYANURIC CHLORIDE AND OF TRIETHYLENE MELAMINE LABELED WITH C^{14}.
D. Lloyd Williams and Anthony R. Ronzio. [nd] 9p. (AECU-1232)

The powerful antimitotic activity of triethylene melamine (2,4,6-triethyleniminyl 1,3,5-triazene) has been reported recently. Since a decrease in mitotic activity is a symptom of radiation injury, a study of this phenomenon was planned using triethylene melamine labeled with C^{14}. This was prepared by the reaction of C^{14}-cyanuric chloride with ethylenimine following the method of Bestian (Ann. 566, 210(1950)). The preparation of C^{14}-cyanuric chloride directly from moist NaCN and Cl_2 on a microscale is described in step-by-step detail. The all-glass system used in this latter synthesis is illustrated.

3394

Texas Agricultural Experiment Station
A NEW METHOD FOR PREPARATION OF C^{14} LABELED GLYCEROL. (abstract) Hermann Schlenk and Bernice Wallace DeHaas. [nd] 1p. (AECU-1261)

The document is reproduced here in its entirety.
Recently authors reported a method for the synthesis of C^{14}-labeled glycerol in which nitromethane and radioactive paraformaldehyde were the starting materials (118th Meeting of American Chemical Society, Chicago, Sept. 1950). The relatively low yield of 19% can be ascribed partly to the quality, i.e., the degree of polymerization of the radioactive paraformaldehyde, and partly to the numerous intermediate steps causing considerable loss of material. The authors have since developed a different method starting from chloroacetylchloride which gives better yields. The quality of chloroacetylchloride is easier to control than that of paraformaldehyde. Chloroacetylchloride may be labeled in the carboxyl group or in the methyl group, producing β- or α-labeled glycerol, respectively. Chlorodiazoacetone is formed according to the Arndt-Eistert reaction and converted to dichloroacetone (Ber. 61, 1124(1928)), the over-all yield being 71%. The reduction of the keto group is possible with a yield of 70% by means of $LiAlH_4$. The resulting dichlorohydrin is saponified with alkali, and the aqueous solution is deionized by use of Amberlite exchange resins. After evaporating the water, the crude glycerol is distilled, giving pure glycerol in a yield of 38% based on chloroacetylchloride.

3395

Sloan-Kettering Inst. for Cancer Research
A SYNTHESIS OF CROTONOSIDE. John Davoll. [nd] 13p. (AECU-1282)

Treatment of 2, 6-diamino-9-β-D-ribofuranosylpurine nitrous acid has yielded 9-β-D-ribofuranosylisoguanine. A comparison of this compound with crotonoside shows the two to be identical in melting point, optical rotation, R_f value on paper chromatograms, ultraviolet absorption spectra in water, 0.05N HCl, and 0.05N sodium hydroxide, and behavior toward Na metaperiodate. X-ray powder diffraction data are shown for anhydrous specimens of the natural and synthetic materials. Some of the properties of crotonoside, however, were found to differ somewhat from those previously reported. Results are tabulated of the consumption of oxidant by natural and synthetic specimens. 12 references.

3396

PREPARATION OF 5.3-YR Co^{60} FROM A COMPLEX. Georges Kayas and Pierre Süe. Bull. soc. chim. France (5) 17, 1145-7(1950) Nov.-Dec. (In French)

In order to concentrate the 5.3-yr Co^{60} formed by Szilard-Chalmers effect in the complex cobaltihexammine, it is preferable to neutron-irradiate the solid salt rather than the aqueous solution, which is highly altered by the pile radiations. Ion exchange is shown to separate the activity to the same extent as precipitation and in a more nearly carrier-free state.

3397

A SIMPLE AND RAPID BIOSYNTHESIS OF ISOTOPICALLY LABELED SUCCINIC ACID. Samuel J. Ajl and Martin D. Kamen. J. Am. Chem. Soc. 73, 2349-50(1951) May. (Note)

Cell suspensions of Escherichia coli (Strain E26) can be adapted to oxidize acetate. If such suspensions oxidize acetate and succinate simultaneously, most of the acetate carbon metabolized is trapped in succinate. Based on this observation, a simple and rapid method for the synthesis of isotopically labeled succinate from labeled acetate has been developed.

3398

SYNTHESIS AND BIOLOGICAL ACTIVITY OF A DEUTERIUM-LABELED ESTROGEN: 2,5-DIDEUTERIO-3,4-DI(p-HYDROX-

YPHENYL) HEXANE. Antoine Lacassagne, Ng.-Ph. Buu-Hoï, Antonio Chamorro, Nguyên Dat-Xuong, and Nguyên Hoan. Compt. rend. 231, 1384-6(1950) Dec. 18. (In French)

This labeled compound has been synthesized in the pure form by the method used by Buu-Hoï and Hoan (J. Org. Chem. 14, 1023(1949)) for the synthesis of hexestrol. Only a slight diminution of biological activity below that of hexestrol was observed in rats given the deuterium-substituted compound.

3399

THE SYNTHESIS OF DL-ASPARTIC ACID-4-C^{14}. S. C. Wang, T. Winnick, and J. P. Hummel. J. Am. Chem. Soc. 73, 2390(1951) May. (Note)

Aspartic acid, labeled in the carboxyl adjacent to the substituted methylene group, has been synthesized in one step from ethyl formylaminomalonate and methyl bromoacetate-1-C^{14}. The yield of the purified product was 63%. The specific radioactivity was about 16,000 cpm/mg, starting from 0.025 mole of methyl bromoacetate containing 1 mc of C^{14}. Attempts were also made to prepare aspartic acid by the reduction of ethyl oxalacetate-4-C^{14} oxime with Na amalgam. Only a 42% yield was obtained in this reduction.

TRACER APPLICATIONS

3400

Los Alamos Scientific Lab.
EXCHANGE BETWEEN RADIOACTIVE IODINE AND DERIVATIVES OF MONOPYRIDINE IODINE(I) IN PYRIDINE. Jacob Kleinberg and James Sattizahn. Nov. 24, 1950. 6p. (AECU-1038; LADC-866(Revised))

The exchange in pyridine solution between radioactive I and pyridine-coordinated unipositive I complexes has been studied. Complete exchange was observed to have taken place immediately after the I and the positive I compound were brought in contact. The exchange was found to be independent of the nature of the organic anion in the complex. Experimental exchange data are tabulated.

3401

Brookhaven National Lab. and Cornell Univ.
DETERMINATION OF DISSOCIATION CONSTANTS OF COMPLEX IONS BY A RADIOACTIVE INDICATOR METHOD. C. M. Cook, Jr., and F. A. Long. [nd] 12p. (AECU-1210)

A radioactive indicator method for determining the dissociation constants of highly stable complex ions can be used when the complex ion is formed from the conjugate base of a weak acid with known ionization constants and when the complex ion interchanges its central metal ion only slowly. The method involves a determination of the metal-ion concentration in a complex solution of sufficient acidity so that partial dissociation has occurred. Application of the method, using $Fe^{55,59}$ tracer, to ferroin gives a K_d value of 8×10^{-22} which agrees fairly well with the value obtained by Kolthoff and coworkers. A similar investigation, with Ni^{63} tracer, of $NiEdt^{--}$, the complex formed from Ni ion and ethylenediaminetetraacetic acid, gives $K_d = 2 \times 10^{-21}$. (auth)

3402

Radiation Lab., Univ. of California
ANION EXCHANGE OF COMPLEX CHLORO-IONS OF ZIRCONIUM, HAFNIUM, NIOBIUM, AND TANTALUM. E. H. Huffman, G. M. Iddings, and R. C. Lilly. Mar. 2, 1951. 8p. (UCRL-1165)

Zirconium, hafnium, niobium, and tantalum form complex chloro-ions in strong HCl which can be exchanged on anion-exchange resins. Some of the characteristics of these exchanges have been studied by tracer techniques and are reported.

3403

THE USE OF ^{18}O IN STUDIES OF THE REACTIVITY OF SOLID OXIDES. E. R. S. Winter. Discuss. Faraday Soc., No. 8, 231-7(1950).

An experimental technique is outlined for following continuously with a mass spectrometer O^{18} exchange between solid oxides and oxygen gas. Preliminary results are presented and discussed for ThO_2 and Cr_2O_3. The apparent activation energy for oxygen exchange is 27 ± 0.5 kcal/mole for ThO_2 between 440 and 540°C. With Cr_2O_3 two processes are operative, one at temperatures below 410°C with an activation energy of 29.5 ± 0.5 kcal/mole and one above 410°C with an activation energy of 1 ± 4 kcal/mole. The high activation energy is ascribed tentatively to a limiting process governed by the rate of desorption of oxygen from the oxide surface. The low activation energy is believed to be associated with the true exchange reaction. The kinetics of these two limiting cases are discussed. (auth)

TRANSURANIC ELEMENTS AND COMPOUNDS

3404

Argonne National Lab.
HEAT AND FREE ENERGY OF THE NEPTUNIUM (IV)-(V) COUPLE IN PERCHLORIC ACID. L. B. Magnusson and J. R. Huizenga. Mar. 8, 1951. 9p. (AECD-3138; ANL-WMM-800; ANL-WMM-801)

The potential of the Np(IV)-Np(V) couple is not directly measurable since the couple does not establish reversible equilibrium at an inert electrode. Reproducible potential measurements were obtainable, however, in solutions containing Np(IV), Np(V), Fe(II), and Fe(III) ions in oxidation-reduction equilibrium. The expected fourth power H ion dependence of the Np(IV)-Np(V) couple was confirmed over the range 0.25 to 1.0M perchloric acid concentration. The heat of the reaction $NpO_2^+ + \frac{1}{2}H_2 + 3H^+ = Np^{+4} + 2H_2O$ in 1M perchloric acid solution was determined from the electromotive force temperature coefficient to be −35.3 ± 0.3 kg-cal. The formal potential of the Np(IV)-Np(V) couple is − 0.746 volt at 25° in 1M perchloric acid solution. (auth)

URANIUM AND URANIUM COMPOUNDS

3405

THE URANYL-CITRATE SYSTEM. I. SPECTROPHOTOMETRIC STUDIES IN ACID SOLUTION. Isaac Feldman and W. F. Neuman. J. Am. Chem. Soc. 73, 2312-15(1951) May. (See also NSA 5-1249)

An analysis of absorption spectra and an application of the method of continuous variations indicate that, from pH 2.0 to 6.0, uranyl and citrate ions combine to form complexes of two combining ratios, represented empirically by UR and U_2R, the former ion being the more stable form. The effect of pH on the stability of these ions is discussed. (auth)

3406

URANYL PERURANATE. Gabriel Tridot. Compt. rend. 232, 1215-16(1951) Mar. 19. (In French)

The yellow precipitate obtained by the reaction of H_2O_2 with aqueous $UO_2(NO_3)_2$ has in the past been given the formulas $UO_4.3H_2O$, $UO_3(UO_2)_2.6H_2O$, $UO_3.H_2O_2.H_2O$, etc. Experiments addition of NaOH to the precipitate, reaction of $UO_2(NO_3)_2$ with Na_4UO_5, thermogravimetry, and infrared absorption spectra prove the presence of one peruranate and two uranyl ions. It is concluded that the substance is $(UO_2)_2UO_5.9H_2O$ at ordinary temperatures, three H_2O molecules being lost between 90 and 120°C, and additional O_2 and H_2O being lost at higher temperatures.

ENGINEERING

3407

Los Alamos Scientific Lab.
THE DESIGN OF A HEART SHAPED CAM. David Moskowitz. [nd] 9p. (AECU-1274; LADC-974)

A method has been devised for determining the contour of a heart-shaped cam for a given set of dimensions through the application of derived formulas.

3408

Health and Safety Div., NYOO
SPECIFICATIONS FOR THE CONSTRUCTION OF LOCAL EXHAUST SYSTEMS. William B. Harris. June 15, 1948. 11p. (NYO-1532)

A standard specification for local exhaust systems is presented. It has been successful, in most cases, in improving the quality of installations of this type. Materials, construction, design, and methods of measurements of air velocity and flow are covered.

HEAT TRANSFER AND FLUID FLOW

3409

Langley Aeronautical Lab.
ANALYSIS OF THE EFFECTS OF DESIGN PRESSURE RATIO PER STAGE AND OFF-DESIGN EFFICIENCY ON THE OPERATING RANGE OF MULTISTAGE AXIAL-FLOW COMPRESSORS. Melvyn Savage and Willard R. Westphal. Dec. 1950. 33p. (NACA-TN-2248)

An analysis is presented of the effect on the operating range and over-all efficiency of a multistage axial-flow compressor of the off-design efficiency characteristics of the blade row. General analytic expressions describing the off-design performance of a blade row are presented. These expressions are analyzed, and the effects of design pressure ratio per stage and off-design blade-row efficiency on the range are discussed. Multistage compressors composed of high-pressure-ratio stages have higher over-all off-design efficiencies and a wider operating range than those made up of low-pressure-ratio stages if the blade row efficiency curves for the two cases are assumed to be somewhat similar. (auth)

3410

Ames Aeronautical Lab.
AN ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF THE SKIN FRICTION OF THE TURBULENT BOUNDARY LAYER ON A FLAT PLATE AT SUPERSONIC SPEEDS. Morris W. Rubesin, Randall C. Maydew, and Steven A. Varga. Feb. 2, 1951. 38p. (NACA-TN-2305)

Average skin-friction coefficients have been measured on an insulated flat plate in turbulent flow at a Mach number of 2.5 for a Reynolds number range of $2.1 \times 10^6 < Re < 6.2 \times 10^6$ and compared with several known existing analyses. The postulates assumed for developing these analyses and the effects of some of the postulates on the average skin-friction coefficient have been shown. It was found that the analysis corresponding more closely to the experimental data for average skin-friction coefficient in the range $0 < M < 2.5$ was an interpolation formula obtained from the numerical integration of Frankl and Voishel's original analysis.

3411

HEAT TRANSFER IN LAMINARY FLOW BETWEEN PARALLEL PLATES. J. A. Prins, J. Mulder, and J. Schenk. Applied Sci. Research (Netherlands) 2A, No. 5-6, 431-8 (1951).

The heat transfer in a liquid when it passes in Poiseuille flow from a hot tube into a cold tube of the same diameter is known as Graetz' problem. The analogous problem with plane parallel plates substituted for the cylindrical tube wall is solved by the introduction of a set of eigenfunctions y_n satisfying the Sturm-Liouville equation $y'' + E(1 - x^2)y = 0$. This solution is compared with the solution of Graetz' problem. (auth)

3412

National Advisory Committee for Aeronautics
HEAT TRANSFER IN A TURBULENT LIQUID OR GAS STREAM; trans. from Z. angew. Math. Mech. 1, No. 4, (1921). H. Latzko; tr. by L. M. K. Boelter. Oct. 1944. 65p. (NACA-TM-1068)

A systematic development of the theory of heat transfer based on the velocity distribution function of Prandtl and Von Kármán, is presented. The fundamental law of turbulent heat exchange is discussed, followed by the theory of steady-state heat transfer in tubes in which the velocity distribution has been established, and of heat transfer in the entrance section. The velocity field in the "calming section" practical computation of the amount of heat transferred, estimation of the internal heating of the fluid by friction heat transfer on a flat plate, and application to real liquids are considered. A total of 24 lengthy notes by the translator adds to the completeness of this treatise.

3413

ON THE INFLUENCE OF ACOUSTIC RELAXATION ON COMPRESSIBLE FLOW. L. J. F. Broer. Applied Sci. Research (Netherlands) 2A, No. 5-6, 447-68(1951)

The equations of motion for a gas in which relaxation can occur are derived. Some general properties of their exact solutions are discussed. In particular it is shown that the relaxation effects a change in the characteristics of the equations, independent of the magnitude of the relaxation time. The equations for steady one-dimensional flow are solved. It is shown from these equations that shock waves have a certain minimal total strength and that steady flow with a speed within the region of possible sound speeds is unstable. Finally some remarks on oblique shocks are made. (auth)

3414

ON THE THEORY OF THE HEAT AND MASS TRANSFER FROM A SPHERE IN A FLOWING MEDIUM AT LOW VALUES OF REYNOLDS' NUMBER. R. Kronig and J. Bruijsten. Applied Sci. Research (Netherlands) 2A, No. 5-6, 439-46 (1951).

A perturbation method is developed for computing the heat transfer from a sphere at uniform constant temperature to a medium flowing past it as a function of the radius of the sphere, the velocity of flow, and the thermal properties of the medium. The results are expressed by giving Nusselt's number as a power series of Péclet's number, the calculation being carried to the second approximation. The formula arrived at can easily be extended so as to apply to the evaporation of or the extraction from spherical droplets. The results are restricted to small values of Reynolds' number. (auth)

MATERIALS TESTING

3415

Metallurgical Lab., Univ. of Chicago
ON THERMAL STRESSES, STRAINS, AND WARPING. F. H. Murray and G. Young. May 17, 1944. Decl. Oct. 16, 1950. 17p. (AECD-2960; CP-1698; A-2428)

A number of results on these subjects are assembled, attention being confined for the most part to such as can be very simply expressed and interpreted with consideration of symmetrical and nonsymmetrical cylindrical systems, spheres, and plates.

RADIOGRAPHY

3416

PROGRESS IN GAMMA RADIOGRAPHY. Atomics (London) 2, 112-18(1951) Apr.

Recent developments in equipment and films have been surveyed. Information on the transport of radioactive materials is included.

VACUUM SYSTEMS

3417

Atomic Energy Research Establishment, Harwell, Berks. (England)
THE REFRIGERATED OIL DIFFUSION PUMP BAFFLE. R. S. Barton. Jan. 1951. 11p. (AERE-G/R-642)

A standard Metropolitan-Vickers 6-in. oil-diffusion pump baffle was operated at temperatures varying from −60 to +13°C while working in conjunction with an 063B-type diffusion pump, and the resulting changes in ultimate pressure within the system under evacuation were observed. The effect on pump speed was also noted. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

3418

EFFECT OF CHROMIUM ON THE OXIDATION RESISTANCE OF TITANIUM CARBIDE. J. D. Roach. J. Electrochem. Soc. 98, 160-5(1951) Apr.

It has been found that a small percentage of Cr in recrystallized TiC improves the resistance of this material to oxidation at elevated temperatures. The amount of oxidation was determined by the increase in weight of specimens of different Cr content after heating in air at 650, 850, 1200, and 1400°C. The data obtained from these tests show that the maximum oxidation resistance, at each temperature, is obtained with an addition of 5% Cr. (auth)

3419

NEPA Div.
HIGH TEMPERATURE REACTIONS IN THE SYSTEM SiC – SiO_2. T. H. Elmer. Mar. 1951. 15p. (NEPA-1770)

Upon heating mixtures of SiO_2 and SiC at temperatures up to 2000°C it was observed that a cloud of vapor was given off. The rate of formation of this vapor was found to be appreciable at ~1750°C and became increasingly pronounced with rising temperature. At ~1900°C the reaction proceeded vigorously and reached completion in a few minutes. At 1950°C it was found that SiO_2 can no longer exist as such in the presence of SiC. The vapor pressure of CO liberated at this temperature is probably atmospheric. The vapor which is given off when SiO_2 and SiC react with each other was found to consist of a mixture of Si and SiO_2, the gaseous phase being CO. The over-all reaction $SiO_2 + 2SiC = 3Si + 2CO$ was found to hold for small concentrations of SiO_2. For higher concentrations of SiO_2 side reactions are postulated. (auth)

3420

NEPA Div.
AN INVESTIGATION OF THE OXIDATION OF SILICON CARBIDE. T. H. Elmer. Mar. 1951. 17p. (NEPA-1768)

Preliminary oxidation tests of approximately 100-hr duration were carried out on granular SiC and on selected coarse crystals of SiC at temperature ranging from 700 to 1550°C. The oxidation results for fresh SiC exposed for 72 hr in air show that oxidation increases rapidly with temperature. No oxidation was observed at 700°C during a 72-hr exposure in air. The rate of oxidation at 950°C is low, and does not decrease appreciably during 100 hr. However, at 1400°C the initially rapid rate of oxidation decreases markedly during the same time interval. In the absence of fluxes, the coating of SiO_2 formed at temperatures above 1400°C (2550°F) may spall off during cooling to room temperature, because of differences in linear expansion between the coating and SiC. The coating formed during oxidation of SiC was found to be SiO_2 in the form of high-cristobalite, which is in agreement with the literature. (auth)

3421

Battelle Memorial Inst.
REFRACTORIES FOR MELTING TITANIUM; PART I. L. W. Eastwood and C. M. Craighead. June, 1950. 26p. (AF-TR-6218(pt.1))

Refractory crucibles were prepared by hot pressing, compressing at room temperature and sintering at elevated temperatures, slip casting, and vapor coating. The "refractories" consisted of carbon, 3 metals, 8 carbides, 6 oxides with or without small additions of other oxides, 2 nitrides, 1 sulfide, 4 borides, and 3 silicides. Sixty-six standardized Ti melts were prepared in the crucibles, and the resulting ingots were examined for contamination. With the possible exception of Zr, all the refractories were appreciably soluble in the Ti melt. Because of the high solubility, none of these materials, with the possible exception of zirconia, appear to be appreciably better than the presently used carbon. Stabilized zirconia was the only refractory not wetted by the Ti melt. Oxygen was absorbed, however, from the ZrO_2 to produce very high hardnesses, but the Zr content of the ingots was generally low, possibly indicating that the ZrO_2 was partially reduced and that lower oxides of Zr might be useful.

METALS AND METALLURGY

3422

Westinghouse Electric Corp., and Westinghouse Atomic Power Div.
REMOVAL OF EMBRITTLING GASES FROM ZIRCONIUM. W. C. Lilliendahl, E. D. Gregory, and D. M. Wroughton. [nd] 10p. (AECU-1226)

A process for the removal of dissolved O_2 in Zr by treating the solid metal in molten or gaseous Ca is described. The equilibrium $O_2 - Zr$ ratios as a function of time and temperature of treating have been determined. The values obtained indicate a final O_2 content of approximately 0.02% O_2 by weight. This figure is in fair agreement with the values obtained by a thermodynamic treatment of the reactions involved. It has been found that N_2 is not removed in the process but that further contamination of the treated metal with N_2 as a source of impurity in the Ca may be prevented by a careful control of treating temperatures. A method for removing source impurity N_2 from Ca by treating with Zr is described. (auth)

3423

Battelle Memorial Inst.
NOTES FROM THE FIRST METALLOGRAPHY CONFERENCE AT BATTELLE MEMORIAL INSTITUTE ON JULY 10, 1949. H. A. Saller and R. F. Dickerson. July 10, 1949. 19p. (AECU-1234)

Metallographic techniques employed by various laboratories engaged in cooperative work on the metallography of U are discussed. Twenty-nine photomicrographs are shown of specimens prepared by various methods.

3424

Knolls Atomic Power Lab.
GUIDE TO LIQUID METAL HANDLING. Liquid Metals Safety Committee, D. B. Nelson, Chairman. Mar. 1, 1951. 9p. (AECU-1273)

The three principal hazards which may be encountered in the use of liquid metals (Na, NaK, etc.) are explosions and fire resulting from their contact with water or other materials of a similar nature, fire resulting from their exposure to air, and injury to personnel by liquid metal contacting the skin. The present guide describes personal safety gear for protection of eyes, hands, etc.; first aid for liquid-metal burns; precautions to be taken in disassembling or repairing liquid-metal systems; tags and signs to be placed in area or on containers and equipment; tools, shields, etc., to be placed on an emergency panel; and fire-fighting techniques.

3425

General Electric Research Lab.
FUNDAMENTAL RESEARCH IN PHYSICAL METALLURGY;

NINTH QUARTERLY REPORT. (Progress Report No. 26) J. H. Hollomon and D. Turnbull. Apr. 5, 1951. 13p. (SO-2013; RL-528)

Preliminary experiments indicate that the activation energy for self-diffusion of Ag is practically independent of Pb content up to the solubility limit and that the velocity of motion of inert markers in a single crystal diffusion couple of Cu-brass is at least a factor of 10 less than the velocity of motion of inert markers in polycrystalline couples. The heat capacity of pure graphite has been measured between 13 and 300°K (data not given). The crystallography of noncoherent twin boundaries has been explained on the basis that the observed relation (113) ‖ (557) corresponds to a high degree of coincidence of lattice sites. (auth)

3426

ACTION OF ANHYDROUS HYDROCHLORIC ACID GAS ON BERYLLIUM AND MAGNESIUM, AND THEIR OXIDES. Jean Besson. Bull. soc. chim. France (5) 17, 1175-9(1950) Nov.-Dec. (In French)

Experiments are described in which the formation of a highly protective layer of very small amounts of the chloride is shown for Be, Mg, Zn, and Cd exposed to dry HCl at ordinary temperatures. For Be, the protection offered is so great that even in powder form the metal is not attacked. This protection disappears with fusion of the chloride, and attack by the gas then becomes rapid. Application to the preparation of pure Be is considered.

3427

Atomic Energy Research Establishment, Harwell, Berks. (England)
A BIBLIOGRAPHY ON THE PREPARATION OF FILMS AND COATINGS OF METALS AND THEIR COMPOUNDS. Mar. 1951. 40p. (AERE-Inf/Bib-70A)

A list of references to published papers which have appeared over the period 1941 to 1950 and to unclassified and declassified reports on the subject is presented.

3428

DIFFERENTIATION OF GRAIN SIZE AND PHASES IN TITANIUM. Constance B. Craver. Metal Progress 59, 371-3(1951) Mar.

Phases and grain sizes of Ti identified by means of polarized light are discussed. This is supplemented by photomicrographs of both etched and unetched samples. A method is suggested for the preparation of Ti for examination.

3429

GRAIN BOUNDARY DIFFUSION IN METALS. A. D. Le Claire. Phil. Mag. (7) 42, 468-74(1951) May.

By an extension of a recent analysis of the problem of grain-boundary diffusion in metals an expression has been derived relating the diffusion coefficients for grain-boundary and for volume diffusion, the effective "width" of the grain boundary, and the angle at time t between a line of constant concentration and the grain boundary at the point where it meets the grain boundary. Some remarks are made on the use of the equation which is applied to a recent experimental observation on grain-boundary diffusion of Cu in Ni. A discussion follows on some aspects of the relation of other work on grain boundaries to grain-boundary diffusion. Evidence is presented, based on models of the grain boundary, which suggests that the activation energies for grain-boundary and for volume diffusion may not differ appreciably.

3430

THE HEATS OF COMBUSTION AND FORMATION OF TITANIUM NITRIDE (TiN) AND TITANIUM CARBIDE (TiC). George L. Humphrey. J. Am. Chem. Soc. 73, 2261-3(1951) May.

The heats of combustion of TiN and TiC were determined by burning the materials in a bomb containing O_2. The standard heats of formation, calculated from the combustion data, are TiN, $-80.4_7 \pm 0.2_7$; TiC, $-43.8_6 \pm 0.3_9$ kcal/mole. Free energies of formation also are listed. (auth)

3431

HIGH TEMPERATURE STRUCTURE AND THERMAL EXPANSION OF SOME METALS AS DETERMINED BY X-RAY DIFFRACTION DATA. I. PLATINUM, TANTALUM, NIOBIUM, AND MOLYBDENUM. James W. Edwards, Rudolph Speiser, and Herrick L. Johnston. J. Applied Phys. 22, 424-8(1951) Apr.

The crystal structures and thermal expansions of Pt, Ta, Nb, and Mo have been determined between 1100 and 2500°K. These metals were found to undergo a uniform thermal expansion over the temperature range of this investigation and to undergo no structural change. The permanent elongation of Ta wires, produced by annealing at temperature between 2473 and 2773°K, appears to be caused by reorientation of crystal grains in the specimen and to preferred direction of crystal growth during annealing, rather than to a change in crystal structure. Quadratic equations have been developed for the thermal expansions of Pt, Ta, Nb, and Mo. Values of the expansion coefficients were computed for the metals by differentiating the equations. These values were compared with those obtained from the Grueneisen theory and indicate that the theory provides a reasonably satisfactory means of extrapolating thermal-expansion data obtained at low and moderate temperatures. (auth)

3432

American Smelting and Refining Co.
LIQUID METAL HEAT TRANSFER FLUID; VOLUMETRIC CHANGES IN ALLOYS FREEZING BELOW 98°C; PROBLEM NO. 526. J. L. Everhart and E. L. Van Nuis. June 19, 1950. 20p. (NP-3015)

The changes in volume of a series of low-melting alloys on freezing and cooling to 20°C have been determined by means of a volumetric dilatometer. The materials investigated were the 11 eutectic alloys, freezing below 98°C, in the systems containing Bi, In, Pb, Sn, and Tl. All the alloys contracted on freezing. Two expanded after solidification while the others showed no such effect. (auth)

3433

THE MELTING POINT–COMPOSITION DIAGRAM OF THE ZIRCONIUM–OXYGEN SYSTEM. Daniel Cubicciotti. J. Am. Chem. Soc. 73, 2032-5(1951) May.

The solidus curve of the Zr – ZrO_2 system has been investigated by observing the melting points of wires of the oxidized metal. The results show that near the melting points O_2 dissolves to the extent of 55 at.% in solid Zr metal, while Zr dissolves in the solid dioxide to form a 15-mole % solution. No evidence was found for compounds other than the dioxide. (auth)

3434

MORE NOTES ON BERYLLIUM. H. Manley. Atomics (London) 2, 84-7(1951) Mar.

Some of the general characteristics of Be are described as a supplement to a previous article (Atomics (London) 1, 78-82(1949)). Sources of Be ore, ore grading, methods of working Be metal, light alloys made with Be, and medical dangers of Be poisoning are discussed briefly.

3435

NITROGEN IN TITANIUM CARBIDE AND TITANIUM–TUNGSTEN ALLOYS; trans. from Tsvetnye Metal., No. 4 (1947). A. N. Zelikman, S. S. Loseva, and N. Ya. Tseytina. 1947. 4p. (NP-2258; OO-W-14705)

The difficulty of preparing Ti carbide in a satisfactory form for Ti alloy production is discussed. The roles of oxygen and nitrogen were investigated in this carbide and in the subsequent sintering of mixtures of TiC and WC. Oxygen was found to be a much more harmful impurity than was nitrogen, the latter having little, if any, effect up to concentrations of about 1% of an alloy.

3436

National Physical Lab.
NOTE ON EXISTING DATA FOR THE THERMAL CONDUCTIVITIES OF CERTAIN METALS. R. W. Powell. June 11, 1945. 13p. (BR-669)

Thermal conductivities, electrical resistivities, and Lorenz functions of U, Th, graphite of various origins, Be, and Nb, as determined by this laboratory or by other investigators, are listed with notes concerning purities, sources, etc. The estimation of thermal conductivities from electrical resistivity data is discussed in detail.

3437

PRODUCTION OF LITHIUM HYDRIDE. Ph. Albert and J. Mahé. Bull. soc. chim. France (5) 17, 1165-7(1950) Nov.-Dec. (In French)

An apparatus is described which permits the production, by hydrogenation of the metal, of 1 kg of 99.6% LiH at each operation (8 hr) with 98.5% yield. Velocity of the reaction of H_2 with Li metal at 700°C was estimated as 1 to 2 $cm^3/cm^3/sec$. A blue coloration of part of the LiH crystals was believed due to a slight excess of Li metal. The diffusion of Li through 2 mm of Fe in 4 hr at 700°C was noted.

3438

THE REACTION BETWEEN OXYGEN AND THORIUM. Pascal Levesque and Daniel Cubicciotti. J. Am. Chem. Soc. 73, 2028-31(1951) May.

A study of the oxidation of Th has been made in order to make comparisons with the oxidations of other metals of group IVB of the periodic table. The reaction was studied in the range 250 to 700°C. Above 450°C, the temperature of the sample was found to rise considerably above the temperature of the furnace; below 450°, the oxidations were found to be essentially isothermal. From 350 to 450°C, the oxidation curves were linear in time. The rate constants for the linear oxidation were measured, and the energy of activation was calculated to be 22 kcal/mole. From 250 to 350°C, the oxidation proceeded according to the parabolic law, and the energy of activation for the reaction was calculated to have a value of 31 kcal/mole. (auth)

3439

Battelle Memorial Inst.
RESEARCH AND DEVELOPMENT ON TITANIUM ALLOYS; PART 2. June 1950. 190p. (AF-TR-6218(pt.2))

Part 1 of the report covered the work on refractories for melting Ti, Part 2 covers the evaluation of various binary, ternary, and more complex Ti alloys, a study of selected high-strength alloys, leading to the selection of an alloy composition consisting of 3.0% Cr, 1.5% Fe, 0.1% N, balance Ti, which is presently being evaluated, and work on analytical methods for determining O_2 in Ti. Some variations in the melting technique, designed to produce more homogeneous alloys, have been employed in the present work. With the binary alloys, the compositional range has been extended in the present work for the systems Ti – Ag, Ti – Be, Ti – Sn, Ti – Pb, and Ti – Ni. Data are also given for alloys of Ti with Ge, Zr, Nb, and Ta. The ternary alloys investigated were based on additions of C, N, Cu, Cr, Mn, Fe, Co, Ni, Va, and W to a Ti–Mo base containing 2.5, 3.5, and 5.0% Mo. Ti–Mn alloys containing 1.75 to 5.0% Mn and additions of C, N, Cu, Co, Mo, and Va comprised another ternary series. Additions of C and N to a Ti–Mo and Ti–Mn base formed two series of quaternary alloys which were investigated. 34 tables. 76 figures.

3440

TEN ZIRCONIUM ALLOYS EVALUATED. PART I. F. B. Litton. Iron Age 167, 95-9(1951) Apr. 5. (See also NSA 5-2797)

The mechanical and oxidation-resistance properties of ten alloys of Zr have been determined. The elements selected for alloying were Hf, Ti, Al, Ta, Nb, W, Mo, Cu, O_2, and N_2. The tensile properties of the Zr alloys are presented in tabular form, and the workability of each is discussed. Hf up to 8.2% did not affect tensile properties. Al increased strength as did Ti, Ta, Nb, O_2, and N_2. In general it was found that Zr alloys are not as resistant to oxidation as the commercially pure metal.

MINERALS AND MINERALOGY

3441

Chemical Research Lab., Teddington
APPLICATION OF ETHYL ACETATE IN CONJUNCTION WITH ACTIVATED CELLULOSE TO THE DETERMINATION OF URANIUM IN MINERALS AND ORES. F. H. Cripps. Dec. 1950. 11p. (CRL-AE-73)

Modifications of standard methods are described in which ethyl acetate is used instead of ethyl ether for the determination of U in minerals and ores employing solid absorbents. These methods have been designed for use at higher atmospheric temperatures without the necessity of incorporating cooling devices for the extraction columns. The procedures have proved satisfactory for normal routine operation where ethyl ether cannot be conveniently employed. (auth)

PHYSICS

3442

Brookhaven National Lab.
KRAMERS' THEOREM AND NUCLEAR EFFECTS IN PARAMAGNETIC ABSORPTION. C. Kikuchi. Nov. 11, 1950. 3p. (AECU-1182)

A relation between the hyperfine-structure-component separation for the Co ion and the angle between the crystalline axis and the applied magnetic field has been pointed out previously by Pryce (Nature 163, 992(1949)). An investigation has been made of the conditions under which this relation would be valid.

3443

Argonne National Lab.
NOTE REGARDING THE THERMAL CONDUCTIVITY OF SYNTHETIC SAPPHIRE. James L. Weeks. Apr. 10, 1951. 3p. (AECU-1284; UAC-377)

Measurements of the thermal conductivity of synthetic sapphire have been made by a steady-state method utilizing samples in the form of a bar. The thermal conductivity of synthetic sapphire was determined to be approximately 0.07 cal/sec cm °C, indicating that the value reported by Knapp (J. Am. Ceram. Soc. 26, 48(1943)) is low by a factor of 8.

3444

Atomic Energy Commission
THE SOLUTION OF THE BOLTZMANN EQUATION FOR A SHOCK WAVE. H. M. Mott-Smith. Jan. 9, 1950. 30p. (WASH-28)

An approximate solution of the Boltzmann equation for a strong shock is given. In the solution, the distribution function has been assumed to be the sum of two Maxwellian terms with different temperatures and mean velocities, but unassigned space densities. The densities were obtained from the solution of a transport equation for u^n, where n is an integer and u is the component of molecular velocity in the stream direction. The calculations are carried out for n = 2 and n = 3. The thicknesses found are considerably greater than those predicted by the Thomas theory.

3445

Atomic Energy Research Establishment, Harwell, Berks. (England)
A MATHEMATICAL ANALYSIS OF THE CONTINUOUS FLOW SYSTEM FOR MEASUREMENT OF THORON EMANATING POWER. J. N. Gregory and J. Howlett. Dec. 1950. 25p. (AERE-C/R-490)

When a continuous flow system is used to measure a fluctuating emanating power, the changes which occur in an ionization chamber are not necessarily exactly identical with the emanating power changes. The system has a finite time constant of responses dependent on its physical construction and electrical circuits, and this causes a lag and distortion in the observation of emanating power variations. The magnitude of these effects has been calculated in order to make corrections in accurate work, and to provide data for interpreting the output of a continuous flow system. The mathematical conclusions are quite general and could be applied to any flow system of gas analysis. (auth)

3446

A RAPID METHOD OF CALCULATING LOG(ft) VALUES FOR β-TRANSITIONS. S. A. Moszkowski. Phys. Rev. 82, 35-7(1951) Apr. 1.

Several graphs and nomographs which make it possible to obtain, very quickly, log(ft) values for most β decays are presented. The use of these figures is discussed. (auth)

3447

REVISED TABLE OF ELEMENTARY PARTICLES OF MATTER—MARCH 1951. Carl D. Anderson. Am. Scientist 39, 260-1(1951) Apr.

A table of 14 distinct elementary particles said to be recognized by physicists at the present time is presented. It is noted that all particles discovered since 1932 are unstable.

COSMIC RADIATION

3448

THE POSSIBLE EXISTENCE OF PRIMARY COSMIC SHOWERS. Anatole Rogozinski. Compt. rend. 232, 328-30(1951) Jan. 22. (In French)

Although it is usually assumed that the primary cosmic-ray particles, protons and heavy nuclei, arrive individually, the same processes of nuclear explosions observed in the atmosphere should ensure that a fraction of the primary cosmic radiation consists of showers arising in collisions

in interstellar space. The phenomena which appear to originate in primary showers and possible experiments to detect these supershowers are discussed qualitatively.

3449

SCINTILLATION SPECTRUM FROM COSMIC RAYS AT 30,000 FEET. L. Reiffel, C. A. Stone, and F. G. Rest. Phys. Rev. 82, 121-2(1951) Apr. 1. (Letter to the editor)

Brief note is made of the cosmic-ray scintillation pulse distribution in anthracene as obtained during experiments conducted in an aircraft at 30,000 ft and a geomagnetic latitude of 50°N. The detector, enclosed in a housing of 1/8-in. brass and 1/16-in. Mumetal, was a ½ by ½ by 1-in. anthracene crystal viewed by a 5819 photomultiplier operated at 900 volts.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

3450

ORIENTATION OF CRYSTALS USING A GEIGER COUNTER X-RAY SPECTROMETER. J. A. James. J. Sci. Instruments 27, 326(1950) Dec.

A Geiger counter x-ray spectrometer is described which enables orientation of single crystals, or large crystals in polycrystalline sheet, to be carried out rapidly without special preparation of the sample. (auth)

3451

THE VIBRATION SPECTRUM OF RUTILE. Bisheshwar Dayal. Proc. Indian Acad. Sci. 32A, 304-12(1950) Nov.

The vibration spectrum of rutile, TiO_2, has been studied by group-theoretical methods. It has been shown that the structure possesses eleven frequencies, four of which are active in the Raman effect, six active in the infrared, and one inactive in both. The numerical values of the frequencies have been worked out on the basis of four empirically assumed force constants. It is found that there is a fair agreement between the observed values of the infrared reflection maxima and the calculated values. The observed and calculated values of the compressibility also agree. (auth)

ELECTRONS

3452

Argonne National Lab.
ELECTRON RECOMBINATION AND THE MOBILITY OF HELIUM IONS IN HELIUM. Roland E. Meyerott. Feb. 1951. 3p. (AECU-1265; UAC-358)

The report is reproduced here in its entirety.

It has recently been pointed out by Bates (Phys. Rev. 77, 718(1950)) that the electron recombination coefficient and the ambipolar diffusion coefficient reported by Biondi and Brown (Phys. Rev. 75, 1700(1949); 76, 302(1949)) are apparently contradictory. The electron recombination coefficient reported must be that of He_2^+ since it is about 10^4 times larger than one would expect for He^+ while the ambipolar diffusion coefficient reported gives a value of the mobility of He ions in He of 13.7 cm^2/volt sec in agreement with the value 13 cm^2/volt sec reported by Tyndall and Powell (Proc. Roy. Soc. (London) 129A, 162(1930)). It has been previously suggested (Meyerott, Phys. Rev. 66, 242 (1944)) that this value is probably the mobility of He^+ in He, while the value 21.4 cm^2/volt sec reported by Tyndall and Powell in 1931 is the mobility of He_2^+ in He. Biondi and Brown have also suggested that their value refers to the mobility of He^+ in He. Thus it would appear that the measurement by Biondi and Brown of the electron recombination coefficient was that of He_2^+, while at slightly lower pressures the measurements of the ambipolar diffusion coefficient was that of He^+. These results are not necessarily contradictory for the electron-recombination coefficient was measured at gas pressures of 28.7 and 21.2 mm and initial electron concentration of about $10^{11}/cm^3$, while the ambipolar diffusion coefficient was measured at pressures from 2 to 12 mm and electron concentration of about $10^9/cm^3$. Not much is known about how the He molecular states are formed in discharges at high pressures, but it seems likely that the metastable molecule He_2^* is formed first and then later ionized to form He_2^+. The molecule formation involves a two- or three-body collision so that the probability of formation is proportional to the square or cube of the pressure. If the molecule ion formation is a two-stage process, the number of molecule ions will vary as the square of the electron concentration used to excite the gas. There is some indication (Meyerott, Phys. Rev. 70, 671(1946)) in discharge tubes somewhat larger than those used by Biondi and Brown, that the number of metastable molecules approximately equals the number of metastable atoms at pressures of about 3 mm. Hence, we might expect that the number of He_2^+ ions exceeded the number of He^+ ions in the Biondi and Brown measurement of the electron recombination coefficient, while the reverse was true under the conditions at which the ambipolar diffusion coefficient was measured. In addition, these experiments are highly selective. Since the electron recombination coefficient of He_2^+ is apparently $\sim 10^4$ times that of He^+, even in a mixture of 50% He^+ and 50% He_2^+, essentially what is observed is that of He_2^+. The ambipolar diffusion coefficient is measured by observing what amounts to the decrease of the number of positive ions with time. The ions with the highest mobility disappear first. If one waits long enough after the discharge has been turned off to observe the ambipolar diffusion, most of the ions of high mobility, He_2^+, will have diffused to the walls and only those of low mobility, He^+, will be left.

INSTRUMENTS

3453

Brookhaven National Lab.
MAGNETIC FIELD MEASUREMENTS WITH PEAKING STRIPS. Joseph M. Kelly. [nd] 13p. (AECU-1090)

The construction of a device known as a "peaking strip" and its use in the measurement of static and dynamic magnetic fields to an accuracy of approximately ±0.02 gauss is described. Fields up to several hundred gauss are easily measured using air-cooled back-bias coils. Using water-cooled back-bias coils the range is extended to the kilogauss region. (auth)

3454

Brookhaven National Lab.
ORBITS IN A FRINGING FIELD. E. M. Hafner. Oct. 18, 1950. 8p. (AECU-1167)

An analytic expression is obtained for the magnetic field in the air path between rectangular semi-infinite pole pieces. The function evaluated on the median plane is found to represent the measured fields of several actual magnets. From the vector potential given by this function, a simple integral representation is written for ion orbits in the median plane. A number of typical orbits are evaluated and plotted. The procedure is useful for estimating the shapes of ion beams entering and leaving such fields and, since the functions are readily differentiable, for calculating vertical focusing effects and the basic properties of certain magnetic spectrometers. (auth)

3455

Sandia Corp.
LOW PASS FILTERS FOR TELEMETERING APPLICATIONS. James L. Dossey. July 19, 1950. 18p. (AECU-1209)

With exacting requirements imposed on the operation of the subchannel modulators used in the FM-FM telemetering system, it became necessary to obtain a filter suitable for use in conjunction with the subcarrier oscillators in order that the desired distortion level could be effectively maintained. The present paper describes, both theoretically and practically, a filter which was found to fill satisfactorily the required specifications. (auth)

3456

Argonne National Lab.
AN AUTOMATIC PLATE COUNTER. Jerome L. Lerner and Donald F. Uecker. Feb. 5, 1951. 13p. (AECU-1260; UAC-348)

An automatic plate counter that is capable of sorting a large number of sample plates into several groups according to their radioactivity has been constructed. The sorting can be done on the basis of α, β, or γ activity. With the exception of the loading and unloading operations, the counter is entirely automatic. It has a capacity of 200 sample plates, and, based on a counting time of 5 min per sample, will function without attention for about 17 hr. The counter can easily be modified for other counting purposes. 4 figures.

3457

Los Alamos Scientific Lab.
RADIO FREQUENCY CONTROL OF MERCURY SYSTEMS. Preston W. Byington. July 26, 1950. 20p. (LA-1132)

When mercury, confined within a glass column, rises inside a high-frequency oscillator coil the oscillations are damped out. Circuits are described that use this effect to control electrical devices by the position of mercury in the column. The Toepler pump control and Manostat control (safety circuit to provide warning of pressure change) are specific applications discussed. (auth)

3458

Sandia Corp.
THE THEORETICAL PATTERN OF THE TURNSTILE ANTENNA. S. Stanley Locus. Sept. 28, 1950. 10p. (SC-1566 Tr)

The turnstile antenna is sometimes used as an end-fire array for the transmission or reception of elliptically polarized waves. Expressions describing the patterns of such an array are given. The expressions for the electric field at any point on a far-field sphere are derived in terms of the relative excitation of the two component arrays of the antenna and the identical E-plane patterns of the two arrays. If the F_θ and E_ϕ components of the electric field are known, the polarization ellipse in any direction can be deduced. (auth)

3459

Oak Ridge National Lab., Y-12 Area
SEMI-AUTOMATIC RECORDING OF WAVELENGTH DATA. G. K. Werner. Mar. 20, 1951. 8p. (Y-735)

Using a comparator, digital converter, and key punch machine, the relative positions of spectrum lines on a photographic plate are automatically punched on IBM cards, which are to be used in an electronic computer to determine wavelengths. (auth)

3460

Atomic Energy Research Establishment, Harwell, Berks. (England)
MAGNETRON DESIGN; THE HOLE AND SLOT RESONATOR. A. W. Aikin. Dec. 1950. 4p. (AERE-X/R-609)

In the design of the Cavendish 25-cm magnetron it has been found necessary to use slot widths greater than those for which previously determined data apply. These data have been extended to cover greater ranges of the parameters. Curves are shown as obtained from points calculated for $w/a = 0.6(0.2)\ 2.0$ and $ka = 0.12(0.08)\ 0.60$, where a = hole radius, w = slot width, and $k = \frac{2\pi}{\lambda}$ (λ = resonant wavelength).

3461

Atomic Energy Project (Canada)
A RELAY PULSE GENERATOR. W. J. Battell and E. E. Chapman. Jan. 9, 1951. 8p. (CREL-467)

The instrument is designed for the calibration of pulse amplitude analyzers and amplifiers. It consists of a 276E mercury relay, attenuators, and a reference voltage supplied by an 85A1 voltage regulator. The relay charges a condenser to the voltage determined by a precision potentiometer and then discharges the condenser into pulse-shaping circuits. The pulse-recurrence frequency is 60 cps, and excellent stability with simplicity of design is obtained. (auth)

3462

Research Lab. of Electronics, Mass. Inst. of Tech.
SERVOMECHANISM SYNTHESIS THROUGH POLE-ZERO CONFIGURATIONS. (Technical Report No. 162) John G. Truxal. Aug. 25, 1950. 102p. (NP-3020)

A servomechanism synthesis procedure based on manipulation of pole-zero configurations is shown to permit simultaneous control over system response in both the frequency and time domain. In addition, this synthesis procedure is based on several important relationships between pole-zero

locations and various criteria of system performance (e.g., error constants or the effect of corrupting signals). The synthesis procedure starts with the selection of an over-all system function meeting performance specifications in both the time and frequency domains. It then simultaneously results in physically realizable compensation networks. From the over-all system function the open-loop transfer function is determined by a simple graphical procedure. The final step in the design is the determination of compensation networks. 15 references. (auth)

3463

A SIMPLIFIED APPARATUS FOR THE STUDY OF NUCLEAR PARAMAGNETIC ABSORPTION. Robert Gabillard. Compt. rend. 232, 324-6(1951) Jan. 22. (In French)

A simple oscillating circuit for detecting nuclear absorption without the presence of dispersion is described, and its sensitivity is discussed. The existence of damped oscillations or "wiggles" was noted with a 0.01N solution of $Fe(NO_3)_3$ and with H_2O_2.

3464

SOME MECHANICAL FEATURES OF A DOUBLE-CRYSTAL NEUTRON SPECTROMETER. G. E. Bacon, J. A. G. Smith, and C. D. Whitehead. J. Sci. Instruments 27, 330(1950) Dec.

A description is given of the mechanical design of a mobile instrument for use with an atomic pile. The two crystal tables and counter arm can be rotated either by hand or electrically, from a remote point if necessary. Angular positions, determined by divided glass circles, can be read to an accuracy of a minute of arc and are displayed on an illuminated screen. Provision is made for automatic operation. (auth)

ISOTOPES

3465

Brookhaven National Lab.
QUANTITATIVE SUMMARY OF NATURAL RADIATION AND NATURALLY OCCURRING ISOTOPES. Frederick P. Cowan. Jan. 4, 1951. 15p. (AECU-1138)

The various components of background radiation and the various naturally occurring radioactive substances are described in a semiquantitative manner. The natural background is universal and of considerable practical importance. Since radiation is a component of man's environment, the ecological results of disturbances to the normal background must be carefully considered. It appears that a detailed understanding of this radiation background is fundamental in connection with problems of radioactive-waste disposal, radiation exposure for large populations, the behavior of sensitive radiation-detection instruments, and a quantitative appreciation of magnitudes used to describe radiation exposures and the quantities of radioactive materials.

MASS SPECTROGRAPHY

3466

MASS SPECTROMETRIC DETERMINATION OF DEUTERIUM BY MEANS OF PHOSPHINE. Hans von Ubisch. Arkiv Fysik 2, No. 6, 517-21(1951).

An account is presented of the analysis of deuterium by using phosphine in conjunction with the 180-deg mass spectrometer. The preparation of phosphine was accomplished by passing the vapor of a few drops of water over Mg_3P_2. Spectra are shown for tap water and D_2O. The mass numbers which make the use of Nier's (Rev. Sci. Instruments 18, 398(1947)) double collector possible also offer an advantage if compared with hydrogen. No complication similar to H_3^+ occurs. Adsorption and hydrogen exchange are troublesome, however, and require considerable attention.

3467

ON A "MOMENTUM" MASS SPECTROMETER. Michael J. Higatsberger. Z. Naturforsch. 6a, 151-4(1951) Mar. (In German)

In order to avoid the difficulties of accounting for the influence of the magnet's stray field on a particle's trajectory in the conventional mass spectrometer, the particle stream may be directed through a canal in one of the poles; in this way the particles enter directly into the homogeneous part of the magnet's field. Particles of all masses are collected upon a definite surface. Absolute measurements of masses can be made. Experiments with such an instrument will be reported later.

3468

ON THE SPIRAL ORBIT SPECTROMETER WITH TWO CONVERGING CIRCLES. Goro Miyamoto. J. Phys. Soc. Japan 6, 68-9(1951) Jan.-Feb. (Short note)

A mass spectrometer, briefly described, makes use of two converging circles, thus enabling two kinds of particles with different momenta to be measured simultaneously.

MATHEMATICS

3469

Argonne National Lab.
SOLUTION OF TWO PROBLEMS ON THE REAC ANALOGY COMPUTER; PROBLEM II. Leslie C. Merrill. January 1951. 2p. (AECU-1230; UAC-336)

The report is reproduced here in its entirety.

This problem which arose in the design of an instrument, is the following: To find the average value of the solid angle subtended by the end of a cylinder as seen from all points inside a smaller concentric cylinder. It may be reduced to evaluation of the triple integral

$$I(\alpha,x) = \int_0^1\int_0^1\int_0^1 \frac{du\,dv\,dw}{\sqrt{x+u+\alpha^2v+2\alpha\sqrt{uv}\cos(2\pi w)}}$$

This integral is calculated on the machine by letting the quantities u, v, w represent the coordinates of a point which wanders randomly through the unit cube. The average value of the integrand is computed from its time integral over a time long enough to ensure essentially complete coverage of the cube. The time spent in the neighborhood of any point must be proportional to the volume of the neighborhood and independent of the location of the point. Such a behavior is obtained by letting u, v, w increase and decrease at con-

stant rates in the range 0 to 1. The time taken in going from u = 0 to u = 1 must be irrationally related to the time taken in going from v = 0 to v = 1, or w = 0 to w = 1. Such a relation is almost certain to occur in practice. The saw-toothed wave forms for u, v, w are generated by integrators with associated switching relays. Each integrator integrates either positive or negative constant voltages, the sign determined by the switching relays. The polarity is automatically reversed when the integrator output passes through 0 or +100 volts. Conventional integration over a period of 5 min or more is impractical because of the inaccuracies introduced by integrating condenser leakage. Accordingly, the time required for the output of the integrator to swing from full negative to full positive output was kept less than ½ min by allowing the integrator to cycle between full negative and positive outputs. This was accomplished in a manner very similar to that used in the generating saw-toothed wave forms. The essential differences were that the quantity integrated was alternately plus and minus the integrand instead of a constant voltage, and the lowest integrator output was −100 volts instead of 0 volts. An ordinary decade scaling counter operated from the 110-volt mains by the switching relay was used to count the integrating cycles. By this means, total effective integrator outputs of several kilovolts are easily attained, whereas the condenser leakage errors never exceed those caused by a potential difference of 100 volts. A plot of u versus v during a 17-min run of the machine is displayed. It is seen that in these two dimensions the coverage is more than adequate. Two values of I were found to be I(0.736, 0.663) = 0.870 ± 0.017, I(0.736, 5.23) = 0.405 ± 0.008. On an analogous two-dimensional problem for which the correct answer could be easily determined, the accuracy was ±0.25%. On the actual problem the accuracy is estimated at better than 2%.

MEASURING INSTRUMENTS AND TECHNIQUES

3470

Brookhaven National Lab.
RESOLUTION OF THE SCINTILLATION SPECTROMETER. A. W. Schardt and W. Bernstein. [nd] 7p. (AECU-1221)

The effect of the photomultiplier tube on the resolution of scintillation spectrometers has been investigated for γ and K x rays between 5.8 kev and 1.3 Mev with a ½-in.-cube crystal of NaI(Tl activated). In the low-energy region the resolution depends primarily on the statistical distribution in the number of photoelectrons leaving the photocathode. From 10 to 35 kev the curve has the statistical $E^{-½}$ slope. At higher energies the resolution was in all cases poorer than expected from the 27-kev measurement and the $E^{-½}$ law.

3471

Purdue Univ.
RANGE-ENERGY CURVE FOR ALPHA PARTICLES IN THE KODAK NTB EMULSION. O. Gailar. [nd] 1p. (AECU-1237)

The report is reproduced here in its entirety.

The range-energy curve for α particles in the Kodak NTB plates, emulsion No. 434,313-9, has been measured for energies between 3 and 19 Mev. Th, Po, and U are used for energies less than 9 Mev, and α particles from the Purdue cyclotron for energies greater than 7 Mev. The α particles from the cyclotron are scattered through 90 deg by a 0.0001-in. Au foil, and impinge on a NTB plate. The energy of these particles is both measured and varied by a rotating Al-foil holder patterned after Kelly (Phys. Rev. 75, 1006(1949)). The experimentally determined curve agrees very well with one calculated by integrating the Bethe stopping-power equation, and is close to the range-energy curve in the Ilford B1 emulsion. Apparatus for measuring the range of Po α particles used for calibrating the various batches of emulsion also is described.

3472

Atomic Energy Project, Univ. of California, Los Angeles
A SENSITIVE COLORIMETRIC METHOD FOR RADIATION DOSIMETRY. George V. Taplin, Clayton H. Douglas, and Butler Sanchez. Mar. 23, 1951. 21p. (UCLA-118)

A colorimetric method for measuring γ radiation in doses as small as 1.0 r unit is described. This unusual sensitivity is accomplished by a simple modification of the original two-phase chloroform-dye system. Acid evolution from chloroform following γ irradiation is increased up to 50 times by removing the ethyl alcohol originally added by the manufacturers as a preservative. Various radiation characteristics of this sensitive system, such as energy, rate, and temperature dependency are described, as well as its stability to heat, freezing, and vibration. Recent developments in the instrumentation of the method are described. The prototype personnel dosimeters shown were prepared for the major purpose of testing the method under field conditions to residual γ radiation from an atomic explosion.

3473

Radiation Lab., Univ. of California
SCINTILLATION COUNTERS FOR THE MEASUREMENT OF RADIOACTIVE SAMPLES. H. O. Anger. Feb. 14, 1951. 21p. (UCRL-886(Rev.))

Application has been made of scintillation counting to problems in biological tracer research. By using scintillation counters to detect the γ radiation of Fe^{59} and Co^{60}, the activity of biological samples has been measured by placing the tissue sample in glass vials without any previous preparation and then placing the vials in the counter. The counting efficiency of the scintillation method described is about equal to the counting efficiency when β particles from electroplated samples are counted by means of a mica-window G-M counter. The background count, however, is several times higher, making it impossible to count very weak samples. Plateau curves are shown for γ rays from Co^{60}, Fe^{59}, and I^{131}. Circuit details are given for a phototube circuit designed to connect directly to a scaling circuit ordinarily used for G-M counting.

3474

Radiation Lab., Univ. of California
ON THE PREPARATION OF STILBENE CRYSTALS. R. F. Leininger. Jan. 26, 1951. 12p. (UCRL-1104)

A crystallization method of preparing large stilbene crystals suitable for use in scintillation counters is presented. (auth)

3475

A COINCIDENCE SCINTILLATION SPECTROMETER. Bo Aler and Olle Bjorklund. Arkiv Fysik 2, 427-30(1951) Jan. 25.

A report is presented of the exploitation of the scintillation counter as a γ proportional device in coincidence work. The system consists of two counters from which pulses are amplified and fed into the coincidence circuit, through a delay line and gate, and into a slow, inexpensive multichannel analyzer. An investigation was made of the original and coincidence pulse distribution of Co^{60} and Na^{22} using a 26-mm anthracene scintillator.

3476

Naval Radiological Defense Lab.
EVALUATION OF THE AN/PDR-7 BETA-GAMMA SURVEY METER. E. J. Wesley. Sept. 19, 1950. 21p. (AD-66(I))

A final evaluation was made of the AN/PDR-7 β-γ survey meter to determine its applicability for use by the Armed Forces. The instrument was evaluated in two main aspects, the physical and the electronic. The tests were designed to stress the capabilities and performance of the instrument. In general, it was found that the instrument is not physically suited for the rough usage and climatic variations of field service, but is electronically good. By use of a halogen-type G-M tube the electronic circuit might well be applied to field-type β-γ survey meters for the Armed Forces. (auth)

3477

GEIGER-COUNTER X-RAY SPECTROMETER—INFLUENCE OF SIZE AND ABSORPTION COEFFICIENT OF SPECIMEN ON POSITION AND SHAPE OF POWDER DIFFRACTION MAXIMA. J. C. Wilson. J. Sci. Instruments 27, 321-5(1950) Dec.

An analysis is made of the optics of a Geiger-counter x-ray spectrometer. The various sources of error are discussed, and expressions are derived for the displacement of centers of gravity and peaks of diffraction maxima.

3478

Atomic Energy Research Establishment, Harwell, Berks. (England)
A LOW GEOMETRY PROPORTIONAL COUNTER FOR α COUNTING. R. Hurst, G. R. Hall, and K. M. Glover. January 1951. 22p. (AERE-C/R-647)

The operation of the Ward chamber has been investigated in considerable detail and the possible errors have been assessed. Using the optimum working conditions the instrument is shown to be both stable and accurate. It can be used for the counting of accurate α standard sources and, in general, for the counting of high-activity sources. (auth)

3479

A SCINTILLATION COUNTER FOR DETECTING FAST NEUTRONS. G. N. Harding. Nature 167, 437(1951) Mar. 17. (Letter to the editor)

A greater sensitivity to neutrons relative to γ rays has been obtained in a scintillation counter by using a powder of KI activated with Tl, the interstices of which were filled with a hydrogenous liquid, α-bromonaphthalene, $C_{10}H_7Br$. The relative sensitivities to neutrons and γ rays of the KI → $C_{10}H_7Br$ mixture and anthracene were measured by irradiating each in turn with 2.5-Mev neutrons from the D-D reaction and 2.62-Mev γ rays from RdTh (Tl^{208}). The number of neutrons counted in the mixture was 0.8% of those which fell on the detector.

3480

THE USE OF POLYTETRAFLUOROETHYLENE INSULATORS IN INTEGRATING ION CHAMBERS. H. Lysons. J. Sci. Instruments 27, 334-5(1950) Dec.

A pocket ionization chamber using polytetrafluoroethylene insulators to space and support the inner electrode from its outer casing is described. A comparison is made of this type chamber to that using amber and polystyrene as an insulator. The natural leakage of this type of ion chamber was found to have a percentage loss of 0.45%/24 hr when charged to 300 volts.

MESONS

3481

ANGULAR DISTRIBUTION OF THE PIONS PRODUCED IN HIGH ENERGY NUCLEAR COLLISIONS. Enrico Fermi. Phys. Rev. 81, 683-7(1951) Mar. 1.

The angular distribution of pions (π mesons) produced in a high-energy collision of two nucleons is discussed in terms of the statistical theory of multiple meson production. The results are compared with experimental findings. (auth)

3482

ON THE DECAY OF A HEAVY MESON INTO LIGHTER MESONS. Shoji Ozaki. Progress Theoret. Phys. (Japan) 5, 373-94(1950) May-June.

Decay schemes of the τ meson have been considered for the processes $\tau \rightarrow \pi + \gamma$, $\tau \rightarrow \pi^{\pm} + \pi^0$, and $\tau^{\pm} \rightarrow \pi^{\pm} + \pi^{+} + \pi^{-}$. It was concluded from the results obtained and from a study of the results of others that the observed phenomena give direct evidence of a pseudoscalar meson with the decay process $\tau \rightarrow 3\pi$. 19 references.

3483

ON THE NATURE OF τ MESONS. II. Hiroshi Fukuda, Satio Hayakawa, and Yoneji Miyamoto. Progress Theoret. Phys. (Japan) 5, 352-72(1950) May-June.

A supplement to a previous detailed mathematical presentation (see Nuclear Science Abstracts, 5-1090) of the nature of τ mesons is presented. The possibilities of the decay of the τ meson are considered for $\tau \rightarrow \pi + \gamma$ and $\tau \rightarrow 3\pi$. A detailed discussion is presented of the types and varieties of mesons, with consideration to the π, μ, and the τ with a mass of $725 \pm 40\ m_e$.

3484

ON THE NUCLEAR INTERACTION OF π^- MESONS IN NUCLEAR EMULSIONS. G. Bernardini, E. T. Booth, L. Lederman, and J. Tinlot. Phys. Rev. 82, 105-6(1951) Apr. 1. (Letter to the editor)

Results are presented of the nuclear stars, scatterings, and stoppings in flight observed in the preliminary analysis of the nuclear interaction produced by π^- mesons in nuclear emulsions in the kinetic energy range 70 to 90 Mev. The experimental arrangement used was similar to that used in the study of mesons of kinetic energy of 30 to 50 Mev (Bernardini et al., Phys. Rev. 80, 924(1950)).

3485

ON THE PRODUCTION OF γ RAYS ACCOMPANIED BY THE ABSORPTION OF π MESON BY A PROTON. S. Ogawa and E. Yamada. Progress Theoret. Phys. (Japan) 5, 503-5 (1950) May-June. (Letter to the editor)

By taking π^- and π^0 mesons to be both scalar or pseudoscalar with scalar or pseudoscalar coupling, the probabilities of the absorption of the π meson by a proton have been estimated for three cases: (a) accompanied by one-photon emission, (b) accompanied by two-photon emission, and (c) accompanied by a neutral meson emission.

3486

ON THE PRODUCTION OF MESONS BY PRIMARY COSMIC RAYS. H. D. Rathgeber. Phys. Rev. 81, 544-51(1951) Feb. 15.

The present ideas on the production of π mesons by the primary cosmic rays and of their decay into μ mesons lead to differences between the calculated and observed intensities, total energies of the components, and geomagnetic effects, which do not appear resolvable by any plausible adjustment. A consistent explanation of the several effects is found in the assumption of a further intermediate meson, which is identified with the τ meson of about 900 m_e. A model which agrees with the available data and is not contradicted by the facts of direct observation, such as in photographic emulsions, consists in the following assumptions: production of τ mesons and π mesons in a ratio of 5 to 1 by the primary nucleons with a multiplicity 2.7 $P^{0.5}$ (P in Bev/c), decay of the τ mesons into π mesons with a mean life of 10^{-10} sec, and decay of the π mesons into μ mesons. (auth)

3487

RADIATIVE CORRECTIONS TO DECAY PROCESSES. I. THE MESON DECAY. Sigeo Hanawa and Tatuoki Miyazima. Progress Theoret. Phys. (Japan) 5, 459-72(1950) May-June.

Results obtained from an investigation of the second-order radiative corrections to the proper lifetime value of the meson are presented.

NEUTRONS

3488

Brookhaven National Lab.
DIRECT MEASUREMENT OF GRAVITY ACCELERATION OF NEUTRONS. (abstract) A. W. McReynolds. Mar. 1, 1951. 1p. (AECU-1218)

The report is reproduced here in its entirety.

Gravity acceleration of neutrons was measured directly by determining the free fall of a highly collimated beam from the Brookhaven reactor. Separation was measured between two beams of different velocity but defined by the same collimating system. Thermal neutrons, of velocity 4×10^5 cm/sec were compared at 12.5-m range with neutrons of 9×10^4cm/sec and less, filtered through BeO, and at 100-m range with fast neutrons of velocity 6×10^5cm/sec and greater, selected by inserting a Cd absorber. Separations are of the order of 1 to 2 mm in both cases and agree within the experimental error of about 10% with the usual value of g.

3489

Atomic Energy Research Establishment, Harwell, Berks. (England)
A DETERMINATION OF THE ABSOLUTE NEUTRON STRENGTH OF A RADIUM BERYLLIUM SOURCE. W. G. L. Brownrigg and D. J. Littler. Oct. 1949. 29p. (AERE-N/R-398)

A Ra – Be neutron source has been calibrated absolutely by a pile measurement in Gleep. The source, which contains 1290 mg of Ra in the form of sulfate mixed with 12 gm of Be, has a neutron strength of 1.01×10^7 n/sec. The accuracy quoted with this figure is ±6%. (auth)

3490

EMISSION OF SLOW NEUTRONS BY A RADIUM-BERYLLIUM SOURCE. E. Giegerl and E. Broda. Nature 167, 399-400(1951) Mar. 10. (Letter to the editor)

The emission of slow neutrons was measured in three energy regions (resonance bands of Dy, In, and I) from a source consisting of 300 mg of Ra mixed with an excess of Be. Total neutron emission was of the order of 3×10^6/sec. Dysprosia, In metal, and CdI_2 were exposed as detectors at varying distances from the source.

3491

Atomic Energy Research Establishment, Harwell, Berks. (England)
EXTENSION OF FEYNMANN'S METHOD FOR DETERMINING NEUTRON ENERGY SPECTRUM AND SPACIAL DISTRIBUTION TO THE CASE OF ANISOTROPIC SCATTERING; PART I. THEORY. B. Davison. Nov. 1950. 19p. (AERE-T/R-590)

The metnod, due to Feynmann, for determining neutron energy spectrum and spatial distribution in a homogeneous multiplying core, surrounded by a container which does not scatter inelastically, is extended to take into account anisotropy of scattering. The method, as originally given by Feynmann, is based on expanding the neutron-emission density in terms of eigensolutions of a fictitious one-velocity problem. In the present extension the work is done in terms of neutron-emission angular distribution instead of neutron-emission density, and instead of one fictitious one-velocity problem there is a set of such problems, each appertaining to a particular spherical harmonic. (auth)

NUCLEAR PHYSICS

3492

Case Inst. of Tech.
NUCLEAR PHYSICS PROGRAM; PROGRESS REPORT;

JULY 1, 1950, TO SEPTEMBER 15, 1950. [nd] 8p. (AECU-1157)

Brief statements are made regarding the operation of, and changes made in, the betatron and its auxiliaries and regarding other phases of work in the laboratory. Report COO-17 for the preceding period, abstracted as NSA 5-1095, is bound with this report.

3493

Radiation Lab., Univ. of California
SUMMARY OF THE RESEARCH PROGRESS MEETING OF FEBRUARY 8, 1951. Bonnie E. Cushman. Mar. 8, 1951. 18p. (UCRL-1133)

Measurement of decay electron spectrum from μ^+ mesons by means of the spiral orbit spectrometer focusing. The experimental arrangement and electron trajectories are illustrated, and graphs of meson intensity distribution are given. The results support the three-particle decay theory of Tiomno and Wheeler (Revs. Modern Phys. 21, 144-52 (1949)). 6 figures. Experiments on proton-proton scattering from 120 to 345 Mev. The results of this experiment are presented in full in UCRL-1109.

3494

A DIAGRAM FOR ESTIMATING UNKNOWN NUCLEAR MAGNETIC MOMENTS. Oswald Riedel. Z. Naturforsch. 5a, 654-7(1950) Dec. (In German)

A diagram is presented containing fairly smooth curves, each for a different nuclear spin value, which give nuclear magnetic moments as a function of mass numbers of both odd-even and even-odd nuclei. The magic nucleon numbers are clearly demonstrated, especially on curves corresponding to small spin values. The diagram permits the determination of the sign and of the approximate value of unknown magnetic moments. The construction of the diagram is based on an extension of a representation known for the deuteron, viz., that a given nuclear spin x/2 is realized by a number x of nucleons. The agreement between the curves and the experimental data on nuclear magnetic moments is very good. (auth)

3495

Princeton Univ.
FINAL REPORT OF NUCLEAR RESEARCH PERFORMED AT PRINCETON UNDER THE JOINT PROGRAM OF THE OFFICE OF NAVAL RESEARCH AND THE ATOMIC ENERGY COMMISSION. Milton G. White. [nd] 24p. (NP-3018)

Reconstruction of the cyclotron, which had been destroyed by fire on Feb. 22, 1950, and changes in its design are described briefly. A few illustrations of the cyclotron after the fire and after reconstruction are given. Research has been continued through the cooperation of Oak Ridge and the Department of Terrestrial Magnetism. Brief summaries of project work on nuclear scattering, β spectra, neutron spectra, positronium detection, etc., results of which, for the most part, have appeared in the literature, are presented. A list of 50 publications arising from this project is given.

3496

Indiana Univ.
FOURTH ANNUAL REPORT. Oct. 1, 1950. 20p. (NP-1880)

The work covered by the series of annual reports of which this is the fourth consists in the determination of nuclear energy levels by measurement of β- and γ-ray spectra and by study of high-energy instantaneous reactions observed in the cyclotron. The present report summarizes results, most of which have appeared in the literature, on energy levels found by the magnetic lens and spectrometer groups and describes briefly the instruments available at the laboratory. Changes made in the cyclotron and design of a beam analyzer magnet and a focusing magnet are described in somewhat more detail.

3497

RULES OF STRUCTURE FOR ATOMIC NUCLEI. M. M. Venkov. Zhur. Eksptl'. i Teoret. Fiz. 21, 51-8(1951) Jan. (In Russian)

A chainlike model of the nucleus is proposed. Based on an analysis of the binding energies of nuclei of mass numbers 9 to 32, a hypothesis involving two-row chainlets of nucleons is suggested. Models of stable nuclei of the second and third periods of the periodic table are given, in which each nucleus is shown to consist of two independent open chainlets, intertwined. These concrete pictures are obtained through the introduction of two new concepts, viz., that of the characteristic number of internucleonic contact bonds, and that of an elementary portion of the total binding energy of the nucleus, which goes to the establishment of one contact bond between two neighboring nucleons; this elementary portion is equal to 6.4 Mev. (auth)

NUCLEAR PROPERTIES

3498

Brookhaven National Lab.
THE MASS OF S^{35} FROM MICROWAVE SPECTROSCOPY. Tunis Wentink, Jr., Walter S. Koski, and Victor W. Cohen. Nov. 7, 1950. 13p. (AECU-1186)

An abstract of this report was indexed as report AECU-1061 and appeared in Nuclear Science Abstracts as NSA 5-1339.

3499

Brookhaven National Lab.
CLASSIFICATION OF NUCLEAR ISOMERS. (abstract) A. W. Sunyar and M. Goldhaber. Mar. 1, 1951. 1p. (AECU-1208)

The report is reproduced here in its entirety.

Nuclear isomers have been reclassified and the following conclusions reached. The lifetime-energy relations of Axel and Dancoff (Phys. Rev. 76, 892(1949)) and the K/L ratios calculated by Hebb and Nelson (Phys. Rev. 58, 486(1940)) yield "l" assignments which are one unit too high for electric 2^3 and 2^4 transitions. Electric 2^3 transi-

tions are 100 or more times slower than expected from Weisskopf's formula (see Hill, Phys. Rev. 81, 470(1951)). Electric 2^4 and 2^5 transitions are also slower than given by Weisskopf, but very few examples are known. Magnetic 2^4 transitions agree very well with Weisskopf's formula. For these transitions, K/L ratios are lower than calculated by Tralli and Lowen (Phys. Rev. 76, 1541(1949)). This discrepancy cannot be explained by admixture of electric 2^5 transitions. The group of isomers of apparently wrong parity in the g 9/2 shell are interpreted as 7/2 + to p ½ − transitions. This is interpreted by assuming that for the configurations $(g\ 9/2)^{3,5,or\ 7}$, the 7/2 + state and the g 9/2 state are comparable in energy. The 7/2 + state is lower in nearly half the cases.

3500

Argonne National Lab. and Brookhaven National Lab.
FAST NEUTRON CAPTURE CROSS SECTIONS AND SHELL STRUCTURE. (abstract) D. J. Hughes, R. C. Garth, and C. Eggler. Mar. 1, 1951. 1p. (AECU-1215)

The report is reproduced here in its entirety.

The capture cross section for 1-Mev neutrons is a direct measure of the average level density in the compound nucleus at an excitation energy equal to the neutron binding plus 1 Mev. Previous cross-section results (Hughes and Sherman, Phys. Rev. 78, 632(1950)) obtained with fission neutrons (effective energy 1 Mev) have shown clearly the increase in level density with atomic weight and the marked decrease in level density (associated with decreased neutron binding energy) at the nuclear shells. The measurements have been continued with special attention to nuclei near the complete shells. The level density for nuclei just above the 82-neutron shell is low but rises to normal at 90 neutrons. The low cross sections for several Ru and Mo isotopes indicate a hitherto unreported shell at 58 neutrons. Several isotopes with neutron number near 110 exhibit a normal level density. The explanation of the observed cross-sectional variation involves both the single-particle nuclear model (low binding for neutrons is excess of filled shells) and the statistical model (rapid variation of level density with excitation energy).

3501

Argonne National Lab.
SCATTERING OF THERMAL NEUTRONS BY MERCURY. C. T. Hibdon, C. O. Muehlhause, G. R. Ringo, and T. R. Robillard. Mar. 5, 1951. 3p. (AECU-1247; UAC-362)

Three thermal-neutron cross sections of Hg, for coherent scattering, total scattering, and absorption, have been measured to be 21.5 ± 2, 26.5 ± 0.1, and 370 barns, respectively. In addition, the potential scattering cross section near thermal (19.5 ev) has been determined to be 13.3 barns. These data have been used to calculate the −2.0 ev resonance parameters in Hg^{199} in an attempt to assign a compound angular momentum value J to the capturing level. The present work favors J = 1, although J = 0 cannot be ruled out with certainty.

3502

Argonne National Lab.
THE NEUTRON RESONANCE IN V^{51}. (abstract) S. P. Harris. Feb. 1951. 1p. (AECU-1256; UAC-352)

The report is reproduced here in its entirety.

Using the high-speed resonance-region neutron-velocity selector (Selove, (Phys. Rev. 76, 187A(1949)), direct measurements have been made on the resonance in V (Harris and Langsdorf, Phys. Rev. 74, 1216A(1948); Hamermesh and Muehlhause, ibid 78, 175(1950)). Hamermesh and Muehlhause give an energy of ~2700 ev for the V^{51} resonance from the correlation of cross-section values in the one-level Breit-Wigner formula. Velocity-selector transmission curves indicate a strong dip at ~2300 ev, in good agreement with the value of Hamermesh and Muehlhause. Transmission curves for V and for several other elements having resonances will be presented, and a brief description of the machine will be given.

3503

Oak Ridge National Lab.
CAN POLARIZATION EFFECTS BE DETECTED IN CAPTURE GAMMA RADIATION? L. C. Biedenharn, M. E. Rose, and G. B. Arfken. Mar. 26, 1951. 19p. (ORNL-986)

The possibility of utilizing polarized neutrons in order to (1) produce other polarized particles and (2) to obtain information on nuclear levels by detecting the emission radiation with polarization-sensitive counters, has been investigated. The fact that the compound state formed by neutron capture decays by photon emission is considered. Emission of other types of particles is briefly discussed. The result of this investigation shows that the intensity as measured with any known (practical) polarization-sensitive detector is isotropic.

3504

ENERGY LEVELS IN THE HIGHLY EXCITED N^{15} NUCLEUS. Wolfgang Stetter and Walther Bothe. Z. Naturforsch. 6a, 61-72(1951) Feb. (In German)

The method of Wilhelmy (Z. Physik 107, 769(1937)) for the measurement of spectra of highly excited compound nuclei was improved as follows: the interfering "wall effects" were eliminated by an anticoincidence device; the column-ionization effects were almost entirely suppressed by the use of a flat ionization chamber in connection with the anticoincidence circuit. In this way the continuous background in the energy spectrum of reaction products was considerably reduced, and the sharpness of the resonance maxima was improved. The study of nitrogen-neutron reactions permitted the extension of the level diagram of N^{15} to 19 Mev above the ground state, and at least 18 terms between 10 and 19 Mev were recorded. The formation of several excited product nuclei was observed. The level density does not increase toward the top of the diagram, as should be expected in accordance with the original Bohr representation; this can be explained by the limited "heat-conductivity" of the nuclear matter. Resonance phenomena were also observed in absorption experiments. (auth)

3505

HYPERFINE STRUCTURE IN PARAMAGNETIC SALTS AND NUCLEAR ALIGNMENT. B. Bleaney. Phil. Mag. (7) 42, 441-58(1951) May.

Abragam and Pryce (Proc. Roy. Soc. (London) 205A, 135 (1951)) have shown that the hyperfine structure in paramagnetic salts can be interpreted by using a simple Hamiltonian involving components of the electron and nuclear spins. On the basis of this Hamiltonian, general formulas are given for the allowed transitions in strong magnetic fields, on the assumptions that the paramagnetic ions have axial symmetry and that interactions with the electric quadrupole moment of the nucleus are small compared with those involving the magnetic dipole moment. General formulas are also given for the energy levels in zero magnetic field, and the allowed transitions are indicated. The use of hyperfine structure in paramagnetic salts for the production of nuclear alignment is discussed, with some quantitative data being given. (auth)

3506

THE NUCLEAR MAGNETIC MOMENT OF I^{129}. Harold Walchli, Ralph Livingston, and Gordon Hebert. Phys. Rev. 82, 97(1951) Apr. 1. (Letter to the editor)

The nuclear resonance of long-lived radioactive I^{129} has been observed in a nuclear induction apparatus of the type originated by F. Bloch and similar to that described by Proctor (Phys. Rev. 79, 35(1950)). I^{129} content of the sample under observation was estimated to be 80%, the remainder being stable I^{127}. Frequency measurements relative to deuterium at nominal fields of 9500 and 12,200 gauss gave $\nu(I^{129})/\nu(D) = 0.86744 \pm 0.0001$. Measurements made on I^{127} at nominal fields of 7500 and 9300 gauss gave $\nu(I^{127})/\nu(D) = 1.30337 \pm 0.0002$. Values of nuclear magnetic moments, in units of the nuclear magneton, were determined to be $+2.6173 \pm 0.0003$ and $+2.8090 \pm 0.0004$, respectively, for I^{129} and I^{127}. 10 references.

3507

ON THE MAGNETIC MOMENTS OF Mg^{25}, Re^{185}, Re^{187}, and Be^{9}. F. Alder and F. C. Yu. Phys. Rev. 82, 105(1951) Apr. 1. (Letter to the editor)

The magnetic moments of Mg^{25}, Re^{185}, and Re^{187} have been determined with a nuclear induction spectrometer to be -0.85466 ± 0.00015, $+3.1433 \pm 0.0006$, and $+3.1755 \pm 0.0006$ nuclear magnetons, respectively. The sign of the magnetic moment of Be^{9} also has been investigated and determined to be negative.

3508

ON THE SPIN AND MAGNETIC MOMENT OF O^{17}. F. Alder and F. C. Yu. Phys. Rev. 81, 1067-8(1951) Mar. 15. (Letter to the editor)

Nuclear induction signals of O^{17} have been observed from H_2O and D_2O and also from other liquids (methanol, ethanol, and acetic acid) containing oxygen, using the spectrometer described by Procter (Phys. Rev. 79, 35(1950)). The resonance was observed to occur at a frequency of 5.8 Mc in an external magnetic field of 10,000 gauss. The ratio of the resonance frequency of O^{17} from H_2O to that of D^2 from D_2O was determined to be 0.88313 ± 0.00004. From the observed results the spin value and magnetic moment of O^{17} have been calculated to be $\frac{5}{2}$ and -1.8928 ± 0.00019 nuclear magnetons. The spin value of $\frac{5}{2}$ with the negative moment approximately equal to the neutron moment assigns a $d_{\frac{5}{2}}$ orbit to the odd neutron of O^{17}.

3509

REMARKS ON VALUES OF NUCLEAR RADII DEDUCED FROM ALPHA RADIOACTIVITY. Georges Ambrosino and Henri Piatier. Compt. rend. 232, 400-1(1951) Jan. 29. (In French)

In calculating the radii of nuclei by Gamow's formula it is necessary to add a value for the differences in ionization potentials and barrier potentials of the initial and product nuclei, totaling about 70 kev for heavy nuclei, to the kinetic energies of particle and recoil nucleus. These corrections bring the calculated radii of U^{238} and Th^{232} into agreement with the normal value $R = R_0A^{\frac{1}{3}}$.

3510

THE SPIN AND MAGNETIC MOMENT OF THE RHODIUM NUCLEUS. H. Kuhn and G. K. Woodgate. Nature 166, 906(1950) Nov. 25. (Letter to the editor)

Brief note is made of the study of the isotope Rh^{103} in naturally occurring Rh. By passing light from a hollow-cathode tube containing Rh through an atomic beam of Rh, observation has been made of absorption spectra at 3434.90 A, showing a well-resolved doublet. From these data it has been concluded that the nuclear spin of Rh^{103} is $\frac{1}{2}$. The splitting is attributed to the ground term which contains an unpaired s electron. The magnetic moment was calculated to be -0.11 nuclear magnetons.

NUCLEAR REACTORS

3511

Carbide and Carbon Chemicals Co., Y-12
BARE PILE ADJOINT SOLUTION. (ANP Central Design Group) M. J. Nielsen. Oct. 27, 1950. 17p. (Y-F10-18)

Multigroup equations and approximate solutions thereof are obtained from the Fermi equations for a bare pile. The equations adjoint to the Fermi equations are derived together with multigroup equations (multigroup adjoint equations) and approximate solutions. An alternate method for obtaining a multigroup solution for the adjoint function is presented, namely obtaining the set of equations adjoint to the set comprising an approximate solution to the Fermi equations (adjoint multigroup equations). It is demonstrated that the two methods, while yielding slightly different values for the adjoint function, are identical for computing the eigenvalue. (auth)

NUCLEAR TRANSFORMATION

3512

Argonne National Lab.
INTERNAL CONVERSION OF NEUTRON CAPTURE γ-RAYS—I. (abstract) C. O. Muehlhause. Feb. 1951. 1p. (AECU-1257; UAC-351)

The report is reproduced here in its entirety.

Low-energy internal-conversion electrons from neutron-capture γ rays have been reported for Cd, Gd, and Br (BNL Report C-7, 1948). The work to be described in this paper was performed at Argonne Laboratory in April 1948. At that time the author made a survey of strong neutron absorbers in an attempt to search for other examples of

this phenomenon. Thin films (~1 mg/cm^2) of Cd, Gd, Sm, Eu, Dy, and Hg were placed in contact with a photographic plate and bombarded in a thermal-neutron flux from the Argonne heavy water reactor. In each case an intense blackening of the plate resulted which could be removed by interposing a few mg/cm^2 of either Al or Be between the absorber and plate. This and other control experiments indicated a prompt soft charged radiation to be present in the capture process. This was identified as an internal-conversion electron. Absorption measurements of the radiation yielded electron energies of the order of 100 to 500 kev. Since in all the materials examined low-energy electrons were found in abundance, it is concluded that low-energy capture states having a long lifetime (~10^{-10} sec) are a common occurrence.

3513

Argonne National Lab.
RADIOACTIVE RECOIL FROM INDIUM METAL SURFACES. (Excerpt from ANL-4552) T. H. Davies and S. J. Yosim. Dec. 8, 1950. 6p. (AECU-1267; UAC-347)

Results are presented of an investigation of recoil In^{116} atoms which can be collected from a solid surface as a result of the recoil given by radiative capture. A discussion is made of a test for In recoil ions in regard to the sequence of γ rays in radiative capture and the position of an internal conversion step in this sequence.

3514

Radiation Lab., Univ. of California
PHOTONUCLEAR STARS IN EMULSIONS. Richard D. Miller. Jan. 12, 1951. 7p. (UCRL-1081)

Ilford C2 emulsions, 200-μ thick, were exposed in the collimated x-ray beam from the 322-Mev synchrotron. Exposures were made at synchrotron energies of 322, 242, and 161 Mev, and the monitor ionization chamber was calibrated relative to pair-production cross sections at each of the three energies by the method described by Blocker et al. (Phys. Rev. 79, 419(1950)). The complete area covered by the beam (⅝-in. circle) on each plate has been scanned for two and more prong stars. Because of the arbitrariness and the difficulty of setting sufficiently precise criteria for this distinction, the two-prong data are regarded as essentially qualitative. The yields of stars with various numbers of prongs are listed. Using the nominal partial densities of emulsion elements given by the manufacturer, and assuming that star-production cross section are proportional to mass number, the 322-Mev yield of 3 and more prong stars give a cross section of Ag, integrated over the bremsstrahlung spectrum, of 6.5×10^{-27} cm^2 per "equivalent quantum." This figure is reduced to 5.6×10^{-27} if cross section is assumed proportional to $A^{\frac{2}{3}}$. The energy distribution of the quanta responsible for the differences in yields from the different energy exposures is shown. Because most of the difference quanta are in the energy range between the two upper limits of the bremsstrahlung spectra, it is possible to calculate a cross section averaged over this energy interval. The average cross sections of Ag for the production of three-or-more-prong stars are 242 to 322 Mev, $(8 \pm 1) \times 10^{-27}$ cm^2; 161 to 242 Mev, $(7 \pm 1) \times 10^{-27}$ cm^2. Relation of these data to possible mechanisms for star production by high-energy photons is considered.

3515

ALPHA-PARTICLES FROM THE PROTON BOMBARDMENT OF OXYGEN-18. J. Seed. Phil. Mag. (7) 42, 566-8(1951) May. (Correspondence)

The yield of α particles from the reaction $O^{18}(p,\alpha)N^{15}$ has been studied using protons of energies 490 to 960 kev having an energy homogeneity of 0.5%. A search for an α-particle group corresponding to transitions to excited states of N^{15} was made using protons of energy 685, 837, and 957 kev and of homogeneity 30 kev. No group of intensity greater than one-tenth of the main group at α energies greater than 1.2 Mev was found.

3516

THE ANGULAR DISTRIBUTION OF PHOTO-PROTONS FROM DEUTERIUM. Gerson Goldhaber. Phys. Rev. 81, 930-5(1951) Mar. 15.

The angular distribution of the photoprotons from the photo disintegration of deuterium was measured. The 6- and 7-Mev rays from the $F^{19} + H^1$ reaction were used as a γ-ray source. Photographic emulsions loaded with deuterium were used to record the photoproton tracks. The angular distribution is best fitted by the expression $a + b \sin^2 (1 + k \cos \theta)$ with values of a/b of 0.09 ± 0.07, 0.17 ± 0.07, 0.15 ± 0.06 for E_γ = 6, 7, and 6 and 7 Mev combined, respectively. For 6 and 7 Mev combined, $k = 0.4\ (+0.2, -0.3)$. Using the 6-Mev γ-ray line as a calibration point, a value $E_\gamma = 7.1 \pm 0.1$ was obtained for the 7-Mev line. (auth)

3517

THE MECHANISM OF STAR PRODUCTION BY GAMMA-RAYS. Seishi Kikuchi. Phys. Rev. 81, 1060(1951) Mar. 15. (Letter to the editor)

The cross section for star production has been determined with a sychrotron bremsstrahlung beam for maximum energies of 300, 250, 200, and 150 Mev by a comparison of the number of stars produced in a photographic emulsion with the number of radioactive atoms produced in a carbon plate exposed to the beam simultaneously. The values of the cross section averaged over all types of atoms, except H, in the emulsion were determined as 6.04 ± 0.41, 5.63 ± 0.56 2.55 ± 0.19, and 1.95 ± 0.18, respectively. Evidence is presented which supports the theory that the interaction of a photon with a nucleus which leads to star production is mesonic rather than an electromagnetic interaction.

3518

THE NEUTRON CAPTURE CROSS SECTION OF Am^{241}. G. C. Hanna, B. G. Harvey, and N. Moss. Phys. Rev. 81, 486-7(1951) Feb. 1. (Letter to the editor)

Am^{241} was irradiated in the NRX pile, and measurements were made of the amount of Cm^{242} produced and of the amount of Am^{241} transformed. The measurement of the residual Am^{241} was complicated by the formation of Pu^{238} from the decay of Cm^{242} as the α particles of Pu^{238} were almost identical in energy with those of Am^{241}. By measuring the Cm^{242} produced in the samples a mean value of the partial cross section of Am^{241} of 568 barns was obtained. The total cross section for Am^{241} transformation was determined as 887 barns.

3519

PHOTO-ACTIVATION OF BISMUTH. Nathan Sugarman and Robert Peters. Phys. Rev. 81, 951-2(1951) Mar. 15.

Work is reported on nonfission activities produced in Bi under irradiation with photons of 48- and 86-Mev maximum energies. The results are similar to those obtained by bombardment with high-energy particles in that many particles are emitted. (auth)

3520

Pennsylvania Univ.
PHOTO DISINTEGRATION OF COPPER. W. E. Stephens and P. R. Byerly, Jr. Mar. 16, 1951. 38p. (NP-3035)

The energy and angular distributions of the protons, deuterons, and α particles and the energy distributions of neutrons emitted from Cu nuclei irradiated with the x rays from a 24-Mev betatron were determined with the use of photographic emulsions. The yields of neutrons, protons, deuterons, and α particles were observed to be 3.6, 1.07, 0.34, and 0.03×10^8 particles, respectively, per mole per roentgen unit. A comparison of the neutron: proton yields and the energy distribution with the theoretical predictions of the statistical models and direct photoelectric action indicate that the photodisintegration of Cu consists mainly in the evaporation of nuclear particles from the excited nuclei. However, the large numbers of deuterons observed can be explained only by a different mechanism such as the "pick up" of a proton by an emerging neutron. About 10% of the neutrons and protons have energies greater than expected from evaporation. These are ascribed to a direct photoelectric effect. The observed angular anisotropy of these high-energy protons supports this interpretation. (auth)

3521

THE PHOTODISINTEGRATION OF THE DEUTERON. W. M. Gibson, T. Grotdal, J. J. Orlin, and B. Trumpy. Phil. Mag. (7) 42, 555-65(1951) May.

The photodisintegration of the deuteron has been observed in photographic plates exposed, while wet with heavy water, to the γ rays arising from the bombardment of fluorine with 1.4-Mev protons. Two groups of protons, produced by the known γ-ray lines at 6.15 and 7.01 Mev, have been clearly resolved. It is shown that γ-ray energies of this order of magnitude can be measured with a probable error of 0.05 Mev, and γ-ray lines with an energy difference of 0.6 Mev can be resolved. Suggestions are made for a further improvement of the technique which should increase the resolving power of the method. The angular distribution of the protons produced by each of the two γ-ray lines has been measured, but statistical uncertainties must be further reduced before any useful comparison with theory can be made. (auth)

3522

General Electric Research Lab.
THE PHOTODISINTEGRATION OF THE HELIUM NUCLEUS. M. L. Yeater and E. R. Gaerttner. Mar. 27, 1951. 35p. (RL-488)

As part of a program of investigating the interaction of x rays with light nuclei, the photodisintegration of He^4 has been studied with a cloud chamber. The "fast recycling" cloud chamber was filled with helium and saturated water and alcohol vapor and irradiated with x rays from the 100-Mev betatron. A total of approximately 500 disintegrations in the helium and vapor were observed. It is found that the (γ,p) and (γ,n) reactions are the preferred modes of disintegration of He^4, while $(\gamma,2d)$ and $(\gamma,2n,2p)$ are relatively weak. The integrated yield for these reactions is about 20% of the total photodisintegration yield of O^{16} or N^{14}. The integrated cross section for helium is approximately 0.1-Mev barn. For the (γ,p) process the measured angles of the emitted particles with respect to the x-ray beam, in the center-of-mass system, are consistent with a $\sin^2\theta$ distribution. The average energy value of the x rays producing the helium disintegration is about 27 Mev. These helium data support the view that large nuclear photo cross sections at high energies result from a nuclear "dipole" type of interaction. The total photodisintegration cross section is in approximate agreement with the theoretical value.

3523

SIMPLE CAPTURE OF ALPHA-PARTICLES. W. E. Bennett, Paul A. Roys, and B. J. Toppel. Phys. Rev. 82, 20-2(1951) Apr. 1.

Gamma rays have been observed from the simple capture of α particles in Li. The γ-ray energies were too large for simple capture in Li^8, but not inconsistent with the reaction $Li^7(\alpha,\gamma)B^{11}$. Three resonances were observed at bombarding energies of 0.401, 0.819, and 0.958 Mev. The corresponding excited states in B^{11} are at 8.90, 9.16, and 9.25 Mev. The yields were too small to use thin targets, but the resonances appeared as steps in the thick-target yield curve. The slope of the steps was largely of instrumental origin for the first two resonances and suggested a width of about 6 kev for the upper resonance. Among the other light elements, only Be and B yielded γ rays when bombarded by 1.4-Mev α particles; but in these cases, the sharp resonances characteristic of simple capture were absent. (auth)

PARTICLE ACCELERATORS

3524

THE CHALK RIVER ACCELERATOR. Atomics (London) 2, 83(1951) Mar.

A brief description is given of the van de Graaff generator capable of producing 4,000,000 volts which was recently put into operation at Chalk River in Canada. It is used as a source of charged particles and as supplementary equipment to the atomic pile.

3525

A DEMOUNTABLE ACCELERATOR TUBE. D. R. Chick and F. J. Miranda. J. Sci. Instruments 27, 337-8(1950) Dec.

Brief note is made of a proton accelerator tube designed for use in a pressurized electrostatic generator. This tube features a large diameter and provides for the removal of the accelerating electrodes without disturbing a large number of vacuum seals.

3526

THE FOCUSING PRINCIPLES OF HIGH ENERGY PARTICLE ACCELERATORS. I. HIGH VOLTAGE ACCELERATORS. Max Hoyaux. Atomics (London) 2, 105-11(1951) Apr.

The first of three papers which summarize how focusing forces are realized in existing or proposed high-voltage accelerators, magnetic field accelerators, and linear high-frequency accelerators is presented. Magnetic deflection, electrostatic optics, electrostatic lenses, thin lenses, coaxial cylinders, etc., are considered.

RADIATION ABSORPTION AND SCATTERING

3527

Nuclear Development Associates, Inc.
STRAIGHT-AHEAD AND ROOT-MEAN-SQUARE-ANGLE CALCULATIONS FOR 20 MC^2 γ-RAYS IN LEAD. Leonard R. Solon and J. Ernest Wilkins, Jr. Dec. 15, 1950. 23p. (NYO-635)

Computations on the penetration of 20 mc^2 (10.2 Mev) γ rays through Pb are made by (a) the straight-ahead method and by (b) a modification thereof, called the "root-mean-square-angle" method, which introduces some allowance for the angular deflections which arise from Compton scattering. In both cases the actual calculations are carried out by a "piecewise" extension of a result due to Greuling. Upon comparing with results obtained by Fano and his coworkers using a Laguerre polynomial expansion method it appears that, out to the distance (about 8 free paths) to which the Fano results extend, the root-mean-square method gives fairly good agreement (within a factor of about 1.5 on overall transmission). (auth)

3528

Radiation Lab., Univ. of California
RANGE ENERGY RELATION FOR 340-MEV PROTONS. R. Mather and E. Segrè. Jan. 24, 1951. 12p. (UCRL-1089)

The angle of emission of the Cherenkov radiation is used to find the velocity of a beam of protons. Their range is also measured, and points of the range-energy relation for energies near 340 Mev for Be, C, Al, Cu, Sn, and Pb are obtained. The data are used to evaluate the average excitation energy for these substances. The results are summarized. (auth)

3529

Harvard Univ.
PROTON-PROTON SCATTERING AT 105 MEV AND 75 MEV. Robert W. Birge, Ulrich E. Kruse, and Norman F. Ramsey. Jan. 31, 1951. 30p. (UCRL-1097)

A detailed description is given of the techniques and equipment used in the study of proton-proton scattering at 105 Mev. The problems encountered in the bombardment of $(CH_2)n$ targets by positrons from the Harvard 95-in. f-m cyclotron are discussed.

3530

Radiation Lab., Univ. of California
ELASTIC SCATTERING OF 83-MEV NEUTRONS. (thesis) Roger Henry Hildebrand. Mar. 5, 1951. 38p. (UCRL-1159)

A relatively high intensity beam of 90-Mev neutrons from a 184-in. cyclotron has been used to explore the elastic-scattering patterns of Be, C, Al, Cu, Ag, and Pb. The measurements were extended to small enough angles to include a large part of the distribution. By measuring the ratio of the scattered neutron flux to the flux incident on the scattering nuclei it was possible to determine the absolute differential scattering cross sections. Total scattering cross sections were obtained by integration of the differential cross sections and also by good and poor geometry attenuation experiments with Al, Cu, and Pb. 17 references.

3531

ABSORPTION AND BACKSCATTERING OF ELECTRONS AND β RADIATION. Georges Charpak and Francis Suzor. Compt. rend. 232, 322-4(1951) Jan. 22. (In French)

The hypothesis that β radiation consists of unstable particles decaying in flight or by inelastic collision in a few mg/cm^2 of matter into electrons and one or more photons of low energy serves to explain such experimental results as the difference between the average energy of RaE (Bi^{210}) radiations calculated from Wilson cloud-chamber histograms and the 15% higher value obtained calorimetrically. The present paper reports evidence from backscattering experiments with electron-emitting Tc^{99m} and β-particle-emitting Co^{60} and P^{32}. The expected simple decreasing function with energy of backscattering of electrons does not hold with β radiation. The radiations of Co^{60} backscattered by Al consist mostly of electrons having energies below 120 kev, the spectrum between 120 and 308 kev being relatively slightly scattered. Twelve mg/cm^2 of Al transmit, in the case of Tc^{99m} electrons, 20% of the direct radiation and 0 ± 1% of the reflected radiation, whereas, in the case of Co^{60}, 15% and 15 ± 4%, respectively, are transmitted.

3532

DIFFUSION OF THERMAL NEUTRONS. Detlof Lyons. Ann. Physik (6) 8, 156-75(1950) Nov. 10. (In German)

The so-called generalized albedo problem has not been solved, so far, because none of the known approximation methods can be applied to obliquely impinging neutrons. Nor did the procedure proposed by Wick (Z. Physik 121, 702(1943)) lead to a satisfactory result. However, since in exact measurements of nuclear-reaction cross sections the generalized albedo problem plays an important part, it is desirable to find some mathematical tool for its solution. These questions are discussed for the linear form of the problem. (auth)

3533

THE ENERGY LOSS OF SLOW DEUTERONS IN HEAVY ICE. A. P. French and F. G. P. Seidl. Phil. Mag. (7) 42, 537-54(1951) May.

A review is made of experimental evidence on the energy losses of protons and deuterons in materials of low atomic number, at energies below about 350 kev. The discrepancies between results of different experiments are discussed, and an attempt is made to arrive at a plausible curve of energy loss as a function of energy for deuterons in heavy ice at energies below 700 kev. The region 0 to 100 kev, which is of considerable interest in the study of the D-D reaction, is given special attention. (auth)

3534

A GEOMETRIC METHOD FOR THE CALCULATION OF THE BACKSCATTERING OF PARTICLES. Léopold Vigneron. Compt. rend. 232, 226-8(1951) Jan. 15. (In French)

An Ilford G5 emulsion, impregnated with a β-radioactive substance, was developed, and horizontal projections of N trajectories of β particles were selected at random. With the point of emission as the origin, the angle subtended by the extreme tangents of each track was measured. A simple relation is shown between the average of N angles (N sufficiently large) and the backscattering of particles from an infinitely thin radioactive layer in an emulsion of thickness greater than the maximum particle range. A measurement of 30 tracks from RaB (Pb^{214}) gave a backscattering probability of 0.24 ± 0.02. Extension of the method to thick radioactive layers or to thin screens is possible.

3535

THE HYDROGEN AND CARBON TOTAL CROSS-SECTIONS FOR NEUTRON ENERGIES BETWEEN 39 MEV AND 156 MEV. A. E. Taylor, T. G. Pickavance, J. M. Cassels, and T. C. Randle. Phil. Mag. (7) 42, 328-30(1951) Apr. (See also NSA 4-5000)

The total cross sections of carbon and hydrogen have been measured at neutron energies of 39, 64.5, and 97 Mev, using a recoil-proton telescope as a neutron detector. At these three energies the hydrogen cross sections are (223 ± 7.6), (126 ± 3), and (73.9 ± 3.0) × 10^{-27} cm^2, respectively. The corresponding carbon cross sections are (1100 ± 20), (784 ± 5), and (508 ± 5) × 10^{-27} cm^2. (auth)

3536

MEASUREMENTS OF GAMMA-RAY ABSORPTION COEFFICIENTS. Charlotte Meaker Davisson and Robley D. Evans. Phys. Rev. 81, 404-11(1951) Feb. 1. (See also NSA 4-2077)

The absorption of γ rays in Al, Cu, Sn, Ta, and Pb was measured using γ rays from I^{131}, Cu^{64}, Mn^{54}, Co^{60}, Zn^{65}, and Na^{24}. Tests showed that scattering from nearby objects and from the absorber was negligible. Tests of the absorption of Ra γ rays in Pb showed good agreement with results of other workers and with theory. The absorption curves of I^{131} showed the presence of a 0.65-Mev γ ray about 15% as abundant as the 0.367-Mev γ ray. Absorption coefficients measured with the other sources showed agreement within 0.5 to 2% with theory. An anomalous absorption coefficient (5% less than expected) with Ta absorber (Z = 73) and Zn^{65} and Co^{60} sources ($h\nu \sim 1.2$ Mev) needs reinvestigation. (auth)

3537

ON THE SCATTERING OF POLARIZED NEUTRONS BY PROTONS. A. B. Bhatia and T. S. Sankaran. Proc. Indian Acad. Sci. 33A, 1-9(1951) Jan. (See also NSA 4-250)

A general expression for the polarization factor for scattered neutrons has been derived in terms of phase shifts, even for the case when the N-P interaction has a noncentral term. It is shown that from a knowledge of the scattering and the polarization cross sections as functions of θ and ϕ (the angle and azimuth of scattering) it is possible to obtain all the unknown phase shifts that determine the neutron scattering.

3538

Atomic Energy Research Establishment, Harwell, Berks. (England)
THE PENETRATION OF GAMMA RADIATION INTO MATTER. J. H. Tait and K. T. Spinney. Feb. 1951. 41p. (AERE-T/R-639)

A method of calculating the energy spectrum of the flux of γ radiation in an absorbing and scattering medium due to irradiation of the surface is described. This consists of the evaluation of the first few terms of the expansion of the flux in a Taylor series in the inverse energy by means of an iteration process applied to the integro-differential equation for the flux. The expression so obtained is accurate only over the upper part of the energy range, and so a modified "age-velocity" method is applied in order to extend the result to lower energies. The theory is used to predict the result of an actual experiment, and good agreement is obtained within its limits of accuracy. (auth)

3539

RANGE-ENERGY RELATION FOR PROTONS AND ALPHA-PARTICLES IN PHOTOGRAPHIC EMULSIONS FOR NUCLEAR RESEARCH. J. Rotblat, J. Catala, and W. M. Gibson. Nature 167, 550-2(1951) Apr. 7.

Previous experiments by Rotblat (Nature 165, 387(1950); NSA 4-2746) for the determination of the range-energy relation in nuclear research emulsions for protons up to 6 Mev and α particles up to 8 Mev have been extended to energies of 16 and 19 Mev, respectively. Two independent experiments in excellent agreement are recorded; both used 8-Mev deuteron beams and Ilford C2 emulsions but it was found that other emulsions differ only slightly in stopping power. Results indicate that the range-energy relation will convert ranges into energy values with an error of less than 1% in the range.

3540

SCATTERING OF 20-MEV ALPHA-PARTICLES BY HELIUM. K. B. Mather. Phys. Rev. 82, 126(1951) Apr. 1. (Letter to the editor)

The angular distribution of α particles elastically scattered from He gas has been determined with a photographic method. Twenty-Mev α particles from a cyclotron entered the scattering chamber from a collimating slit system and were recorded by their tracks in photographic emulsion

placed at known angles behind each slot. Listing is made of the calculated center-of-mass cross sections.

3541

SELF-ABSORPTION CORRECTIONS FOR LARGE GAMMA-RAY SOURCES. W. R. Dixon. Nucleonics 8, No. 4, 68-72 (1951) Apr.

Reduction in γ-ray intensity by self-absorption is calculated for homogeneous- and parallel-source radiation. A general correction equation is derived which is applicable to linear, cylindrical, spherical, and certain other source shapes. (auth)

RADIATION EFFECTS

3542

MODIFICATIONS PRODUCED BY α-PARTICLE IRRADIATIONS IN CdS CRYSTALS. Immanuel Broser and Ruth Warminsky. Z. Naturforsch. 6a, 85-102(1951) Feb. (In German)

Changes produced by irradiations with α particles in the luminescence properties and electrical conductivity of synthetic CdS crystals were measured. Whereas the luminescence is always reduced by the action of α rays, the conductivity is modified by some combination of both an increasing and a decreasing effect. An explanation of these actions of α particles on the position of crystal electrons, based on the band model of the lattice (Riehl and Schön, Z. Physik 114, 682(1939)), is offered.

RADIOACTIVITY

3543

Radiation Lab., Univ. of California
THE U^{227} COLLATERAL SERIES. W. W. Meinke, A. Ghiorso, and G. T. Seaborg. Feb. 21, 1951. 3p. (AECD-3133; UCRL-1141)

Continuation of investigations of the type which led to the observation and characterization of five artificial radioactive chains collateral to the natural radioactive families has led to the partial identification of one additional chain, collateral to the actinium (4n + 3) family. The following assignments have been made by α systematics to radiations observed following a 1-min irradiation of Th with 175-Mev He ions.

Isotope	Type of radiation	Half-life	Energy of radiation (Mev) Observed	Predicted
U^{227}	α	1.4 (+0.15, −0.3) min	7.0 ± 0.1	7.0 – 7.2
Th^{223}	α	($\sim 10^{-1}$ sec, predicted)	7.5 ± 0.1	7.5 – 7.7
Ra^{219}	α	($\sim 10^{-2}$ sec, predicted)	7.8 ± 0.1	7.9 – 8.1
Em^{215}	α	($\sim 10^{-3}$ sec, predicted)	8.6 ± 0.15	8.6 – 8.8
Po^{211}	α	0.52 sec	7.434	
Pb^{207}	Stable			

3544

Brookhaven National Lab.
CROSS OVER TRANSITION OF Tc^{99m}. (abstract) J. N. Mihelich, M. Goldhaber, and Elizabeth Wilson. Mar. 1, 1951. 1p. (AECU-1217)

The report is reproduced here in its entirety.

Medicus, Maeder, and Schneider (Helv. Phys. Acta 22, 603 (1949); Phys. Rev. 81, 652(1951)) have shown that Tc^{99m} (6 hr) decays in two steps, a 1.8 ± 0.3-kev transition followed by a 141.2 ± 0.5-kev transition with the latter identified from its K conversion coefficient as a magnetic dipole transition. The authors have found the expected crossover transition by photographing the internal conversion electrons from a thin Tc^{99m} source in a high-resolution 180-deg magnetic β spectrograph. Two K and L lines were observed, corresponding to γ rays of 140.1 ± 0.5 and 142.1 ± 0.5 kev. The difference is 2.0 ± 0.1 kev. From the relative intensity of the electron lines the crossover transition can be estimated to take place in about 1% of the disintegrations and can be assigned to a $p_{1/2} - g_{9/2}$ transition (2^4 magn). The small energy difference between the $g_{9/2}$ ground state and the $^1/_2+$ excited state, as well as a still smaller difference (9.3 kev) observed by Bergström (Phys. Rev. 81, 638(1951)) for Kr^{85} can be interpreted by assuming that the $(g_{9/2})^{3 \text{ or } 7}$ configurations have two low-lying states: $^1/_2+$ and $g_{9/2}+$.

3545

Argonne National Lab.
GAMMA-RAYS IN THE DECAY OF THE RADIO-ISOTOPES OF CERIUM. (abstract) H. B. Keller and J. M. Cork. Feb. 1951. 1p. (AECU-1255; UAC-353)

The report is reproduced here in its entirety.

The enriched isotopes of Ce were obtained from the Oak Ridge National Laboratory, and were bombarded in the Argonne heavy-water-moderated nuclear reactor. The activities thereby induced were examined for conversion electrons in a permanent-magnet-type, photographic β spectrometer. The γ rays deduced from the experimental data are summarized below:

Radioisotope	γ rays (kev)	Mode of decay	Half-life
Ce^{137}	2.53.4	K capture	36 hr
Ce^{139}	166.0; 275.2	K capture	140 days
Ce^{141}	145.7	β	28 days
Ce^{143}	57.5; 290.6; 348.4	β	33 hr
Ce^{144}	34.0; 41.3; 46.8; 53.7; 80.9; 95.0; 100.5; 134.5	β	300 days
Pr^{144}	61.0	β	17.5 min

Decay schemes will be proposed.

3546

Argonne National Lab.
INTERNAL CONVERSION OF NEUTRON CAPTURE GAMMA-RAYS. (abstract) Carl T. Hibdon and C. O. Muehlhause. Feb. 14, 1951. 1p. (AECU-1259; UAC-349)

The report is reproduced here in its entirety.

Low-energy neutron-capture γ rays from Gd and Sm^{149} have been measured with a 180° -focusing permanent-magnet β spectrograph. A well-collimated beam of neutrons from the Argonne heavy-water reactor passes through the spec-

trograph and irradiates a neutron absorber which is located in the usual source position. Internal conversion electrons from this absorber are focused on no-screen x-ray film. Several lines resulting from a Gd absorber are easily observed and are associated with two γ rays, one of 80 kev and another of 90 kev. The K, L_2, L_3, and M lines occur for the 80-kev γ ray and the K and L_3 lines for the one at 90 kev. A faint line always observable at a higher energy could not be associated with either of these two γ rays. If interpreted as the K line of a third γ ray, the energy of this γ ray is 188 kev. Only one line from a Sm^{149} absorber is observed with this instrument, and if interpreted as a K line, the γ ray has an energy of 294 kev.

3547

Argonne National Lab.
THE INTERPRETATION OF ISOMERIC TRANSITIONS. (abstract) Steven A. Moszkowski, Feb. 16, 1951. 1p. (AECU-1263; UAC-355)

The report is reproduced here in its entirety.

Graphs of the theoretical half-life–energy relation for nuclear isomeric transitions according to the recently developed theory of Blatt and Weisskopf (private communication) are shown. According to this theory, many isomeric transitions can now be assigned to magnetic 2^4-pole radiation, consistent with predictions from the Mayer shell model (Phys. Rev. 78, 16(1950)). There are a number of isomeric transitions with half-lives of 1 sec to 1 hr, which cannot be due to magnetic 2^4-pole radiation. A possible explanation of these transitions for odd-A nuclides is that one of the states involved in the transition has a spin determined by the coupling of several odd nucleons, rather than by one odd nucleon. On this assumption, the transitions might be expected to be electric 2^3 pole. Actually, these isomeric states occur exactly for those nuclides for which one would expect "many-particle" levels according to the shell model. Some difficulties associated with this explanation will be discussed, particularly the question of half-lives for electric transitions.

3548

Argonne National Lab.
A STUDY OF THE ELECTRON LINE SPECTRA OF CERTAIN NEUTRON INDUCED RADIOACTIVITIES. Harry B. Keller. Mar. 1951. 84p. (ANL-4595)

The construction and operation of the permanent-magnet-type, 180°-focusing, photographic spectrometer used in this experiment are described in detail, the nature of γ-ray-emitting disintegration processes are discussed, and the electron line spectra of Pa^{233}, Eu^{152}, Er^{171}, Ce^{137}, Ce^{139}, Ce^{141}, Ce^{143}, Ce^{144}, Pr^{144}, Hf^{175}, Hf^{179}, Hf^{180}, and Hf^{181}, as obtained experimentally in the present research, are tabulated. Proposed decay schemes for these nuclides are presented. 17 tables. 22 figures. 98 references.

3549

Radiation Lab., Univ. of California
U^{235} ALPHA FINE STRUCTURE. A. Ghiorso. Feb. 8, 1951. 3p. (UCRL-1117)

U^{235} α-particle radiation has been resolved into at least three groups by use of a 48-channel differential pulse analyzer. A typical pulse analysis is shown. By comparison with a pulse analysis of radioactively pure samples of U^{234} and U^{238}, it is deduced by a process of elimination that the isotope U^{235} is responsible for the peaks at 4.58, 4.40, and 4.20 Mev. The possibility of a fourth α-particle group at 4.47 Mev is suggested. The abundances of the various groups and their consequent partial α half-lives and the presumed decay sequence of U^{235} are given.

3550

Radiation Lab., Univ. of California
DECAY OF Np^{236}. D. A. Orth and G. D. O'Kelley. Mar. 2, 1951. 6p. (UCRL-1160)

In a study of the decay schemes of Np^{236}, U^{235} was bombarded with the deuteron beam from a 60-in. cyclotron and the electron spectrum of purified Np fractions were observed on a β-ray spectrometer. Samples of chemically pure separated Np^{236} were evaporated from a concentrated HCl solution on conducting Tygon films about 30 $\mu g/cm^2$ thick. Auger electrons, internal conversion electrons, and β particles were observed. The β spectrum is complex, and resolution of Fermi-Kurie plots of the data indicate β energies of 0.51 and 0.36 Mev. A pair of internal conversion lines corresponding to the K and L conversion of a 150-kev γ ray was also observed.

3551

THE DISINTEGRATION SCHEME OF I^{131}. P. R. Bell, Judith M. Cassidy, and G. G. Kelley. Phys. Rev. 82, 103-5 (1951) Apr. 1. (Letter to the editor)

Note is made of the study of 8-day I^{131} using coincident scintillation spectrometers. The result of the γ-γ and β-β coincidence spectra lead to a consistent decay scheme of I^{131} including the 720-kev γ ray recently found by Zeldes et al. (Phys. Rev. 81, 642(1951)). 4 figures.

3552

DISINTEGRATIONS OF Nd^{147} and Pm^{149}. Evani Kondaiah. Phys. Rev. 81, 1056-7(1951) Mar. 15. (Letter to the editor)

Note is made of the slow-neutron bombardment, in the Harwell pile, of Nd_2O_3 which yielded Nd^{147} and Nd^{149} having half-lives of 11 days and 2 hr, respectively. Nd^{149} decays by negatron emission to Pm^{149} which further decays with a half-life of 2 days. The properties of the irradiation as observed using a β-ray spectrometer are discussed.

3553

THE INVASION OF THE ATMOSPHERE BY RADIOACTIVITY OF ATOMIC EXPLOSIVE ORIGIN AND ITS INFLUENCE ON ATMOSPHERIC PRECIPITATION. Hubert Garrigue. Compt. rend. 232, 1003-4(1951) Mar. 5. (In French)

Aerial observations on the rapid increase of the 20- to 30-hr radioactive substance (labeled "A") on February 3, 1951 leave no doubt as to its origin in atomic explosions. A large part of the radioactive cloud must enter the stratosphere and fall back to earth very slowly. The portion of the cloud diffusing into the troposphere supplies abundant condensation nuclei which profoundly affect the processes of precipitation. Rainfall was observed to free the air of radio-

activity. Conclusions as to the effect of extensive atomic bombing are drawn.

3554

A NEW SHORT-LIVED ISOTOPE OF CESIUM. Richard W. Fink and Edwin O. Wiig. J. Am. Chem. Soc. 73, 2365-6 (1951) May. (Note)

Cs^{128} has been prepared by bombarding CsCl for 2 hr with 96-Mev protons from the University of Rochester 130-in. cyclotron. The resulting 2.4-day Ba^{128} has been shown to decay through a 3.13 ± 0.2-min activity, which has been assigned to Cs^{128}. Although the Cs^{128} radiations have not been characterized, these may be the 3-Mev positrons previously reported to be in equilibrium with the Ba^{128} radiations.

3555

ON THE DECAY OF $Xe^{125} \rightarrow I^{125} \rightarrow Te^{125}$. Ingmar Bergström. Phys. Rev. 82, 111-12(1951) Apr. 1. (Letter to the editor)

The existence of Xe^{125} is confirmed in a note on the neutron irradiation of Xe in the Harwell pile. Beta spectra are shown of Xe^{125} and I^{125}. It is concluded that Xe^{125}, half-life 18 ± 0.5 hr, decays predominantly by K capture to several excited states of I^{125} which decay by K capture to Te^{125}.

3556

ON THE RADIOACTIVITY OF Hf^{181} and Hf^{175}. Arne Hedgran and Sigvard Thulin. Phys. Rev. 81, 1072(1951) Mar. 15. (Letter to the editor)

Hf isotopes of a pile-irradiated sample have been separated electromagnetically resulting in the observation of an isotope Hf^{181} and also one of mass number 175 amounting to about 2.5% of the total activity. These separated isotopes were used as samples for β-spectrometer investigations from which it was determined that the mass number 175 was due to Hf^{175} which decays by K capture to Lu^{175}, having two K conversion lines of energies 26 and 279 kev.

3557

RADIATIONS OF Nd^{147}. W. S. Emmerich and J. D. Kurbatov. Phys. Rev. 81, 1062(1951) Mar. 15. (Letter to the editor)

Nd^{147}, obtained by pile irradiation of pure Nd, has been studied using a permanent-magnet spectrograph, a thick-lens β spectrometer, and coincidence counters. The obtained results allow a tentative establishment of a decay scheme for Nd^{147} with a total energy of disintegration of ~915 kev, in which three β spectra of 825, 600, and 380 kev are followed by the transitions of 91-, 320-, and 534-kev γ rays, respectively. Gamma rays of 534 kev as well as 38-kev x rays could be observed by absorption, while a 91-kev transition appears to be largely internally converted.

3558

RADIATIONS FROM Zr^{89}. Kalman Shure and Martin Deutsch. Phys. Rev. 82, 122(1951) Apr. 1. (Letter to the editor)

Brief note is made of a study of 79.3-hr Zr^{89}, produced by the Y(d,2n) reaction. The momentum distribution of the particles emitted from Zr^{89}, as measured with a thin-lens magnetic β-ray spectrometer, is shown.

3559

THE RADIOACTIVE DECAY OF I^{131}. J. M. Cork, W. C. Rutledge, A. E. Stoddard, C. E. Branyan, and W. J. Childs. Phys. Rev. 81, 482-3(1951) Feb. 1. (Letter to the editor)

Brief note is made of the spectrometric studies of the γ rays and their half-lives associated with the decay of I^{131}. Gamma rays have been observed having energies of 28.0 (Auger x), 80.1, 163.6, 177.0, 284,1, 364.2, 637, and 723 kev. All were found to decay with a half-life of 8 days except the 163-6-kev γ ray which is presumably associated with a 12-day metastable state in Xe.

3560

RADIOACTIVE STRONTIUM PRODUCED BY DEUTERON BOMBARDMENT OF RUBIDIUM. Michel Ter-Pogossian and Fred T. Porter. Phys. Rev. 81, 1057-8(1951) Mar. 15. (Letter to the editor)

Note is made of the results of a bombardment of RbCl with 10-Mev deuterons which yielded Sr^{85m}, Sr^{87m}, and Sr^{85}. The radiation of these isotopes has been observed using a 14-cm radius of curvature, uniform field, semicircular magnetic spectrometer. Half-lives of 65 ± 3 days, 70 min, and 2¾ hr were observed for Sr^{85}, Sr^{85m}, and Sr^{87m}, respectively.

3561

RUBIDIUM 84; A NEW ISOMER WITH A 23-MIN HALF-LIFE. A. Flammersfeld. Z. Naturforsch. 5a, 687-8(1950) Dec. (Note; in German)

By irradiation of Rb salts with Li + D neutrons, a new Rb activity of 23-min half-life was identified and attributed to Rb^{84m} formed in a $Rb^{85}(n,2n)$ reaction. The decay seems to be of a complex nature (0.32-Mev electrons, γ rays, no positrons) pointing either to a K capture followed by an emission of conversion electrons, or, at least partially, to an isomeric transition into 40-day Rb^{84}.

3562

SHORT-LIVED KRYPTON ISOTOPES AND THEIR DAUGHTER SUBSTANCES. O. Kofoed-Hansen and K. O. Nielsen. Phys. Rev. 82, 96-7(1951) Apr. 1. (Letter to the editor)

Note is made of the investigation of the isotopes Kr^{89}, Kr^{90}, and Kr^{91} and their daughter substances. Kr, formed in the fission of U, was pumped through a 10-m-long tube directly from the cyclotron into the ion source of an isotopic separator. The cyclotron and the isotope separator were operated simultaneously, and the counting was begun immediately after the interruption of the separator. Half-lives were measured to be 3.18 min, 33 sec, and 10 sec for Kr^{89}, Kr^{90}, and Kr^{91}, respectively. It was found that at least 35% of the decays of Kr^{89} lead to the excited state of Rb^{89} which lies ~2 Mev above the ground state. Furthermore, it was found that Rb^{91} has an isomeric state. Both states (half-lives 100 sec and 14 min) decay to Sr^{91} (9.7 hr), which decays to the 60-day and 50-min isomers of Y^{91}.

SHIELDING

3563

Oak Ridge National Lab.
REPORT ON THE USE OF BARYTES AGGREGATES IN CONCRETE FOR SHIELDING PURPOSES. Edward G. Tirpak. Apr. 13, 1950. Decl. Apr. 10, 1951. 22p. (AECD-3134; ORNL-667)

The use of barytes as aggregates in heavy concrete has been investigated with regard to shielding properties and cost of production. Results show that a baryte concrete of a uniform density of 1.5 times that of ordinary concrete and with desirable shielding properties can be produced economically.

THEORETICAL PHYSICS

3564

THE ENERGY-MOMENTUM VECTOR IN THE UNIFIED DIVERGENCE-FREE QUANTUM ELECTRODYNAMICS. Hermann Kümmel. Z. Naturforsch. 5a, 642-4(1950) Dec. (In German)

The energy-momentum vector is deduced from a classical expression given by Wheeler and Feynman (Revs. Modern Phys. 21, 425(1949)); in the unified quantum electrodynamics of Ludwig (Z. Naturforsch. 5a, 637(1950)), omitting his theory of holes, this vector furnishes a vanishing self-energy. (auth)

3565

FORMAL INTEGRATION OF THE EQUATIONS OF QUANTUM THEORY IN THE HEISENBERG REPRESENTATION. Gunnar Källén. Arkiv Fysik 2, 371-410(1951) Jan. 25.

The differential equations of quantum electrodynamics and meson theory are formally integrated in the higher approximations without use of the interaction representation. It is first shown that the commutator formulas of Schwinger and the P symbols of Dyson satisfy the recurrence formulas in the Heisenberg representation. This method of integration, however, has the disadvantage of not avoiding the complications involved in the normals of the space-like surfaces. In the second part the differential equations are solved directly by being substituted into themselves. Explicit formulas are given in the simplest cases, and the analysis is carried so far that the general structure also of the more complicated expressions can be inferred. The calculations are at this point a little more delicate than the use of the $S_F(x)$ and $D_F(x)$ functions (at least for particles of spin ½, where no surface terms appear) but give an interesting insight into some of the prescriptions of the earlier method. The theory for particles of integer spin is also investigated, and the similarity to the case of spin ½ is stressed. In the appendix the removal of a special form of indeterminacy in the theory is illustrated by a simple example.

3566

PREMISES TO A DIVERGENCE-FREE QUANTUM ELECTRODYNAMICS. Günther Ludwig. Z. Naturforsch. 5a, 637-41(1950) Dec. (In German)

The causes of divergences in current theories do not lie in the perturbation theory but in the interaction principle itself. It is possible to construct a quantum electrodynamics without introducing the self-energy of the electron, in which an electron, alone in the universe, would not emit any radiation; the radiation appears only as a result of interactions with many other electrons (an "absorber theory"). (auth)

PATENTS

CHEMISTRY

3567

CYCLIC ORGANIC FLUORINE COMPOUND AND METHODS OF MAKING. F. B. Stilmar (to U. S. Atomic Energy Commission). U. S. Patent 2,553,217, May 15, 1951.

Organic compounds containing one or more chlorinated aromatic nuclei are acted upon by a fluorinating agent such as antimony pentafluoride or arsenic pentafluoride to effect a simultaneous replacement of chlorine by fluorine and saturation of double bonds to produce progressively more saturated compounds.

3568

ELECTROLYTIC CELL WITH WELDED ANODE ASSEMBLY. A. F. Benning, G. W. Feldmann, R. C. McHarness, and M. K. Richards (to U. S. Atomic Energy Commission). U. S. Patent 2,550,445, Apr. 24, 1951.

This patent covers an anode-supporting structure which will resist the corrosive action of fluorine and hydrogen fluoride in an electrolytic cell for manufacturing fluorine by fused-salt electrolysis.

3569

HYDROGEN PURIFICATION METHOD. E. D. Klema (to U. S. Atomic Energy Commission). U. S. Patent 2,547,874, Apr. 3, 1951.

A method is set forth for purifying hydrogen which comprises passing the hydrogen over a hydride of calcium or titanium at a temperature of at least 250°C.

3570

MANUFACTURE OF ORGANIC FLUORINE COMPOUNDS. M. A. Perkins (to U. S. Atomic Energy Commission). U. S. Patent 2,549,988, Apr. 24, 1951.

Perfluorinated alkanes are produced by a process which comprises a progressive replacement of chlorine by fluorine in a halogenated aliphatic hydrocarbon by means of a pentafluoride of antimony or arsenic, with intermediate

separation of more highly fluorinated fractions and inorganic salts, after which the highly fluorinated fractions are further treated with a higher fluoride of cobalt, silver, or manganese.

3571

METHOD OF FLUORINATING ORGANIC COMPOUNDS WITH MOLTEN SILVER FLUORIDES. R. G. Benner (to U. S. Atomic Energy Commission). U. S. Patent 2,549,565, Apr. 17, 1951.

An organic compound is fluorinated by injecting the organic compound and elemental fluorine into a molten mass of silver monofluoride and silver difluoride maintained at a temperature of 200 to 500°C.

3572

PROCESS FOR THE PREPARATION OF NEPTUNIUM TETRAFLUORIDE. Sherman Fried and Norman R. Davidson (to U. S. Atomic Energy Commission). U. S. Patent 2,549,899, Apr. 24, 1951.

Neptunium tetrafluoride is prepared by contacting neptunium dioxide with hydrogen fluoride in the presence of an oxidizing agent at a temperature between 300 and 1000°C.

3573

PRODUCTION OF URANIUM PEROXIDE. Paul Mohr (to U. S. Atomic Energy Commission). U. S. Patent 2,551,543, May 1, 1951.

Uranium peroxide is precipitated by the simultaneous addition of hydrogen peroxide and a water soluble base, such as ammonium hydroxide, to a solution containing a uranyl salt in such a manner as to maintain a pH of 2.5 to 4.0.

3574

RADIOACTIVE PRODUCT AND METHOD OF PRODUCING THE SAME. L. B. Werner (to U. S. Atomic Energy Commission). U. S. Patent 2,554,476, May 22, 1951.

The element americium is removed from solution by mixing a carbonate solution of pentavalent tantalum with a solution containing pentavalent americium and heating to precipitate tantalum as a hydrated oxide to carry americium from the solution.

3575

SEPARATION OF FLUORINATED HYDROCARBONS BY DISTILLATION WITH HYDROGEN FLUORIDE. K. C. Johnson (to U. S. Atomic Energy Commission). U. S. Patent 2,549,609, Apr. 17, 1951.

Fluorinated hydrocarbons having the same carbon skeleton but differing from one another in the number of hydrogen atoms replaced by fluorine atoms are separated by distillation in the presence of hydrogen fluoride to provide an overhead product containing two liquid phases.

3576

SEPARATION OF RADIUM FROM BARIUM. E. R. Tompkins (to U. S. Atomic Energy Commission). U. S. Patent 2,554,649, May 29, 1951.

An adsorption-chromatographic elution process for separating radium values from barium or other materials is described.

ENGINEERING

3577

GUIDING MEANS FOR MOVEMENT OF SOLID MATERIALS. C. H. Prescott, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,547,409, Apr. 3, 1951.

This patent describes a device useful in removing incrustations or sublimate from the interior of a vessel by an apparatus operable from the outside of the vessel through appropriate seals.

3578

IMPROVED VACUUM PUMPING METHOD WITH MECHANICAL OIL SEALED PUMPS. F. A. Knox (to U. S. Atomic Energy Commission). U. S. Patent 2,551,541, May 1, 1951.

A method in high-vacuum pumping systems using rotary mechanical pumps is described wherein dry air or gas is introduced into the outlet of the pump to prevent condensation of otherwise condensable vapors therein and thereby avoid the mixing of such condensate with the pump oil being returned to the pump.

3579

PRESSURE MEASURING DEVICE. W. R. Peret. (to U. S. Atomic Energy Commission). U. S. Patent 2,554,792, May 29, 1951.

A pressure-measuring device of the Philips ion-gauge type consists principally of two Philips gauges so connected to a source of a-c or d-c power supply that corresponding electrodes of the two gauges are opposite in polarity.

MINERALOGY, METALLURGY, AND CERAMICS

3580

BERYLLIUM TARGET AND METHOD OF MANUFACTURE. J. G. Hamilton, T. M. Putnam, and J. H. Wiens (to U. S. Atomic Energy Commission). U. S. Patent 2,549,596, Apr. 17, 1951.

A cyclotron target of beryllium bonded to copper is produced by bonding a beryllium plate or beryllium filings to a copper block by means of an intermediate layer of copper and beryllium, the bonding being accomplished by the use of pressure and heat.

PHYSICS

3581

CORONA TRIODE VOLTAGE REGULATOR. C. M. Turner (to U. S. Atomic Energy Commission). U. S. Patent 2,548,452, Apr. 10, 1951.

An improved grid control for a corona-discharge voltage regulator used to regulate the potential of the high-voltage shell of a van de Graaff electrostatic generator is described.

3582

FLUOROPHOTOMETER. C. R. Marsh and C. B. Pickle (to U. S. Atomic Energy Commission). U. S. Patent 2,551,542, May 1, 1951.

A fluorophotometer for measuring intensity of fluorescence is described in which reflectors are used to restrict the travel of the light waves and to direct them along predetermined paths, thus reducing loss of light to a minimum while increasing sensitivity.

3583

ION GAUGE. S. Bashkin (to U. S. Atomic Energy Commission). U. S. Patent 2,548,283, Apr. 10, 1951.

This patent covers an improved ion gauge of high sensitivity wherein the bombardment of the filament and the formation of a carbonaceous deposit thereon are minimized.

3584

MASS SPECTROMETER. A. C. Nier and M. G. Inghram. (to U. S. Atomic Energy Commission). U. S. Patent 2,551,544, May 1, 1951.

The mass spectrometer described is of simple and relatively inexpensive construction and is capable of analyzing light gases or isotopes thereof with a comparatively high degree of resolution.

3585

MONITORING CIRCUIT. G. M. Farly and D. A. Mack (to U. S. Atomic Energy Commission). U. S. Patent 2,550,460, Apr. 24, 1951.

This patent covers a monitoring circuit for parallel-operated mercury-pool gas tubes which is designed to differentiate between arcback and misfire failures in the tubes and to register the number of each of such failures.

3586

PHOTO-MULTIPLIER CIRCUIT. L. F. Wouters (to U. S. Atomic Energy Commission). U. S. Patent 2,554,933, May 29, 1951.

This patent describes a photomultiplier circuit useful as a scintillation counter wherein a pair of photomultiplier tubes are positioned to receive light from a single source, with the electrodes of the tubes so interconnected that output of one tube controls the output of the other tube.

3587

PRODUCTION OF RADIOACTIVE HALOGENS. A. F. Reid (to U. S. Atomic Energy Commission). U. S. Patent 2,554,316, May 22, 1951.

A radioactive halogen having a high ratio of radioactive atoms to inactive atoms is produced by bombarding with neutrons an organic halide to which has been added a free halogen which is chemically distinct from the halogen in the organic halide.

3588

PULSE AMPLITUDE DISCRIMINATOR. F. J. Davis and L. F. Curtiss (to U. S. Atomic Energy Commission): U. S. Patent 2,551,529, May 1, 1951.

The pulse amplitude discriminator described is responsive to pulses varying in amplitude and varying in rate, and is so designed that the amplitude response characteristics may be adjusted without altering or impairing the rate of respondability.

3589

PULSING CIRCUIT. H. H. Staub (to U. S. Atomic Energy Commission). U. S. Patent 2,550,878, May 1, 1951.

This patent describes a simple pulsing system in which the amplitude of the output pulses may be made to vary cyclically in accordance with a predetermined pattern.

3590

RADIATION COUNTER. C. R. Marsh (to U. S. Atomic Energy Commission). U. S. Patent 2,550,488, Apr. 24, 1951.

A pulse-type survey instrument for detecting radiation employs a proportional counter and permits the use of an amplifier of low gain for reducing microphonic effects.

3591

RADIATION COUNTERS. M. S. Freedman (to U. S. Atomic Energy Commission). U. S. Patent 2,551,531, May 1, 1951.

A gas-filled radiation counter is so designed that a radioactive sample may be introduced without introducing any air or other foreign gases.

3592

SENSITIVITY MODULATOR. H. H. Staub (to U. S. Atomic Energy Commission). U. S. Patent 2,548,449, Apr. 10, 1951.

The invention disclosed is an improved feedback amplifier, the sensitivity of which is adapted to be modulated in response to an introduced signal.